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SEPT. 1965

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Westinghouse Astronuclear Laboratory

DEVELOPMENTAL TEST PROGRAM PRESENTATION

(TITLE UNCLASSIFIED)

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Westinghouse Astronuclear Laboratory

DEVELOPMENTAL TEST PROGRAM PRESENTATION

(TITLE UNCLASSIFIED)

SPECIAL REREVIEW FINAL DETERMINATION
Class: U

Reviewer	Class.	Date
KAW	U	4-12-82

Classification cancelled (~~or changed to~~ _____)
by authority of _____
by H.T.C. TIC, date SEP 1 1 1973

GROUP-1
EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION

INFORMATION CATEGORY
Confidential - R.D.
K.H. Lee Cleary 9/14/65
Authorized Classifier Date

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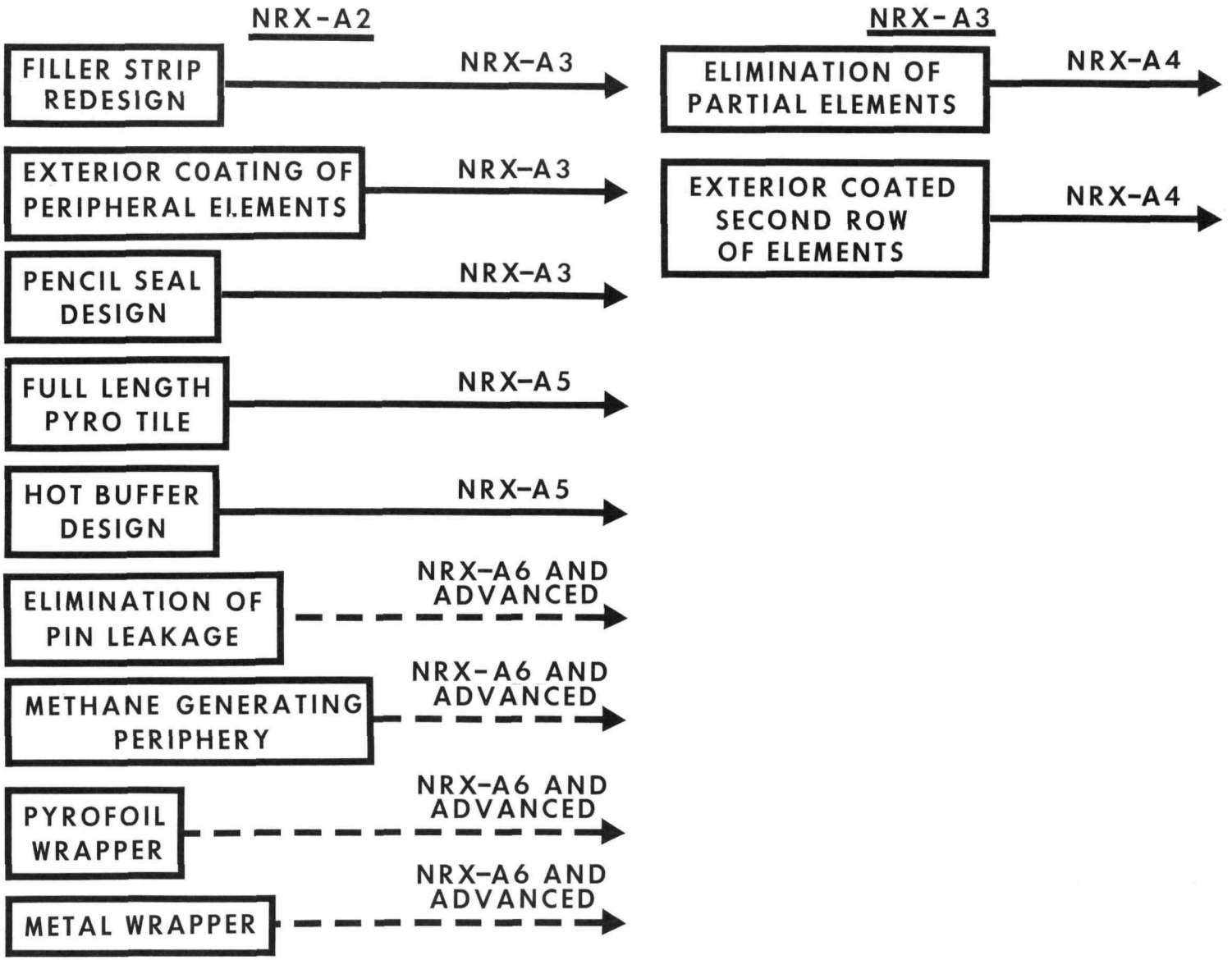
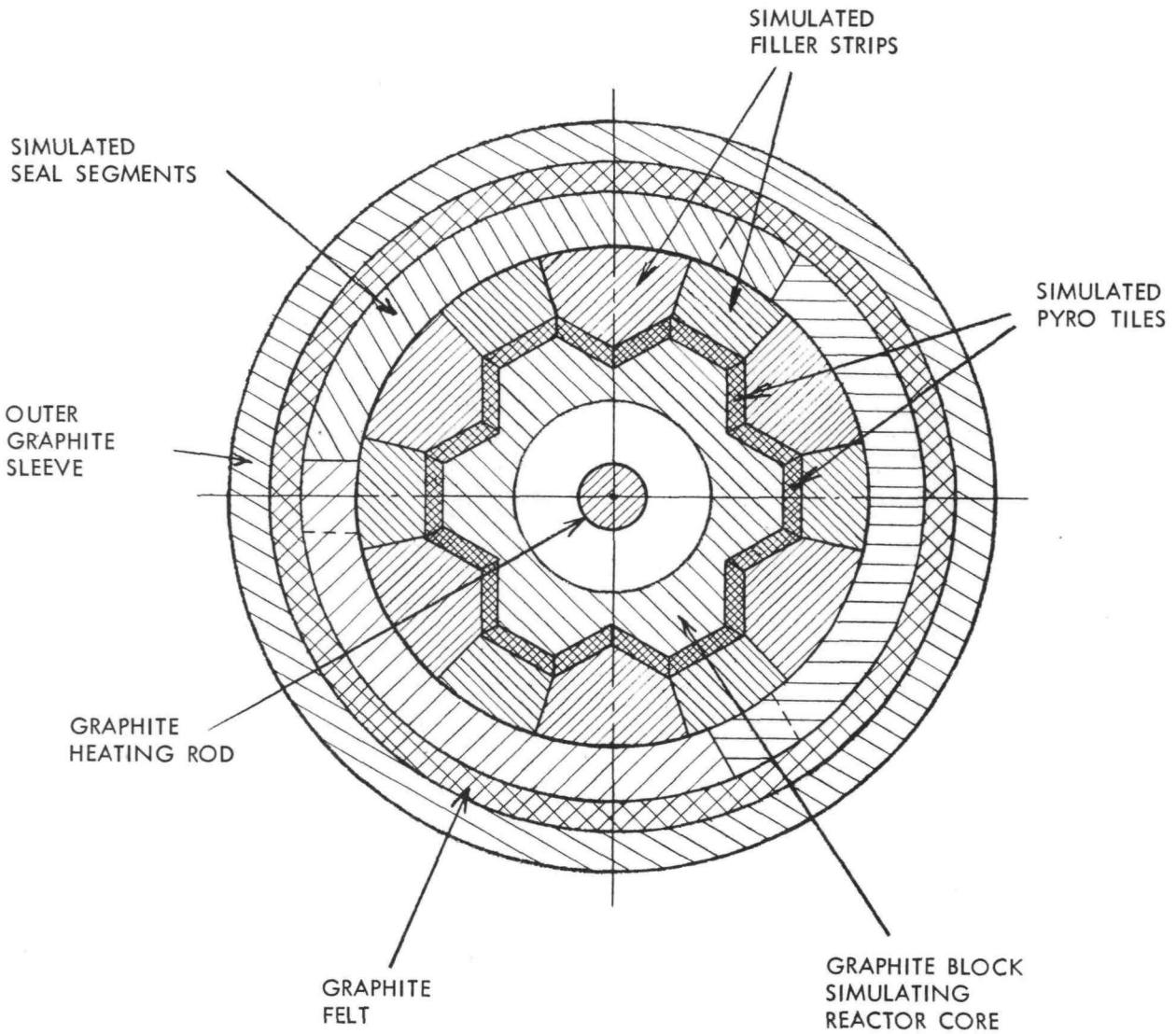
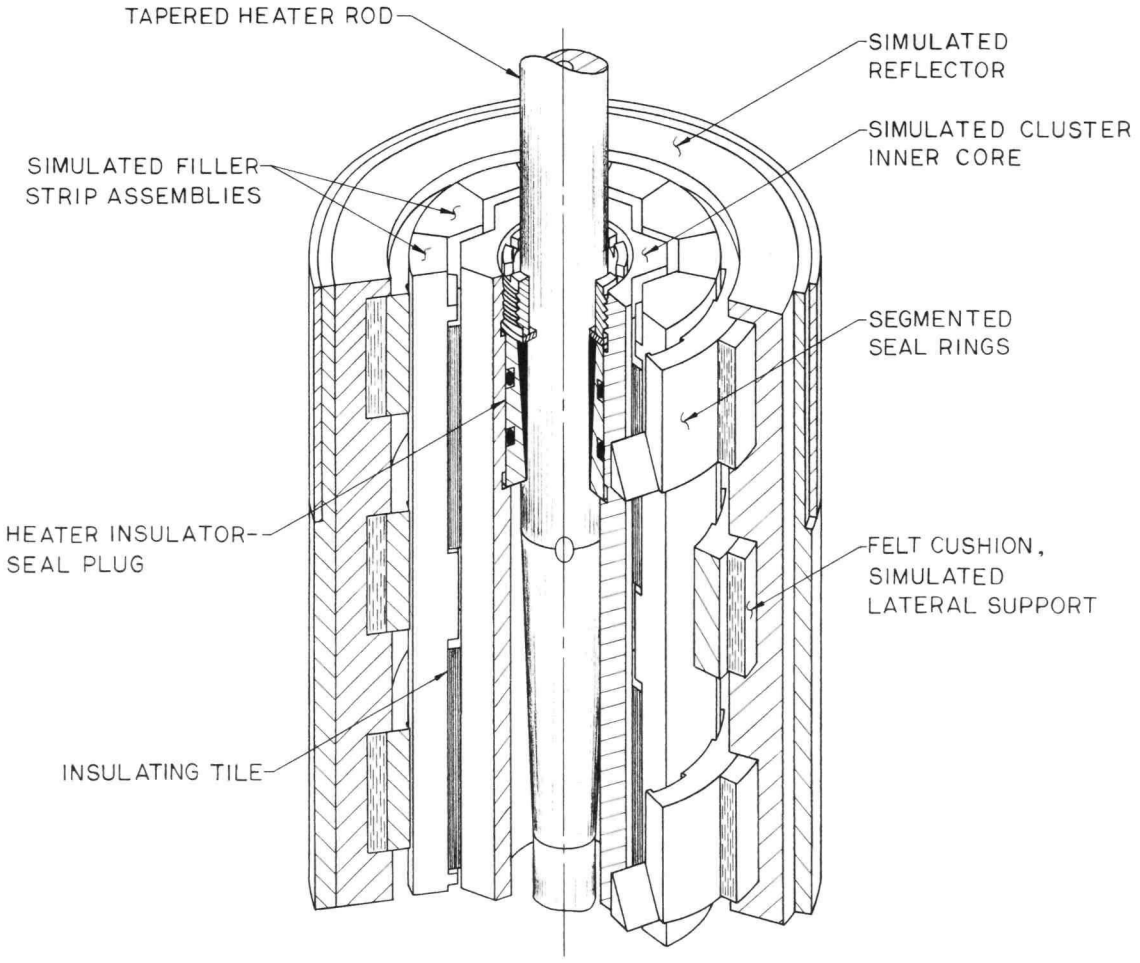
PERIPHERAL CORROSION

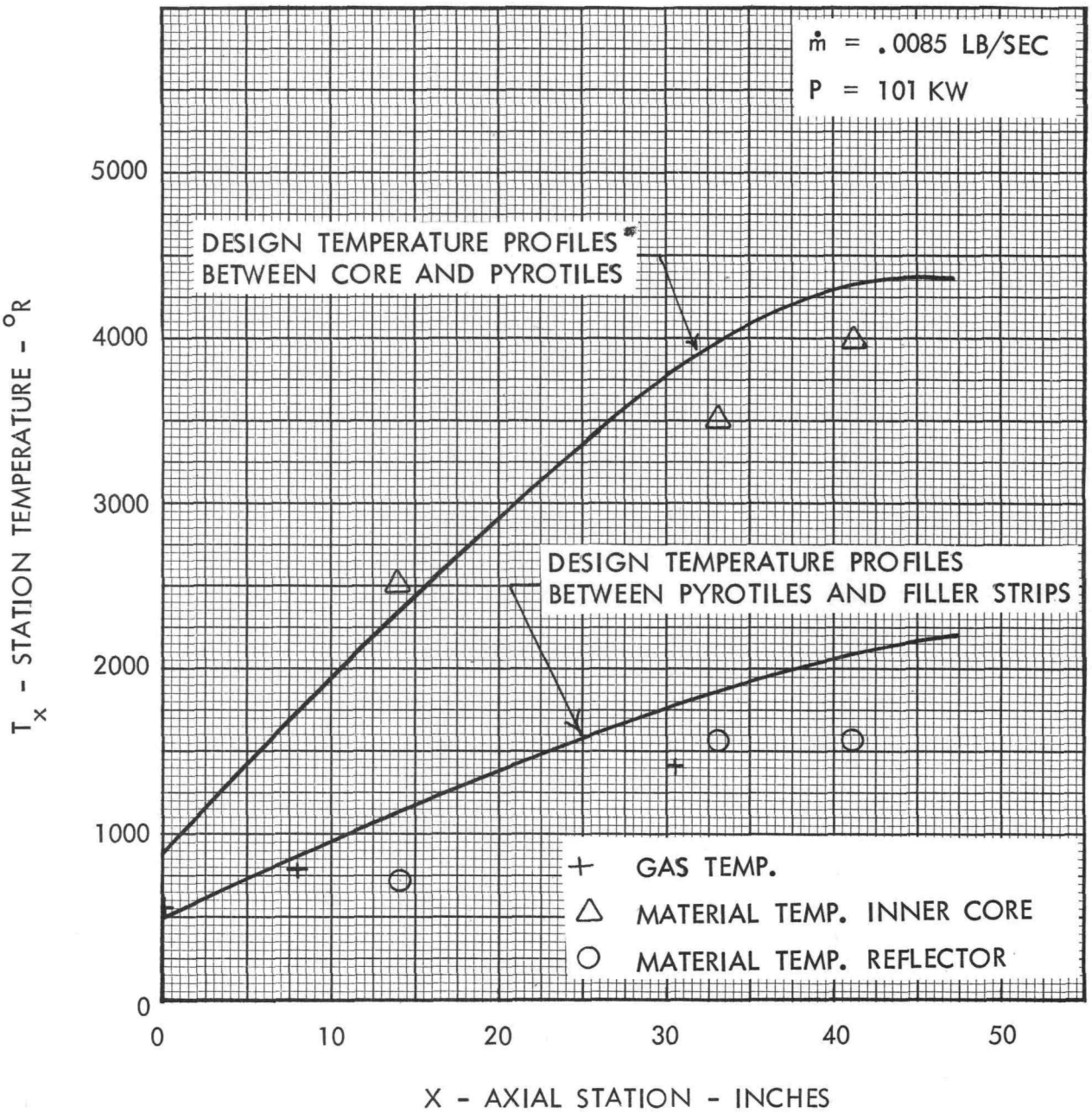




SCHEMATIC CROSS-SECTION OF PROPOSED
FILLER STRIP CORROSION TEST SECTION



SIX - INCH DIAMETER
FILLER STRIP CORROSION TEST MODEL



TYPICAL AXIAL TEMPERATURE MEASUREMENTS COMPARED WITH DESIGN DISTRIBUTION

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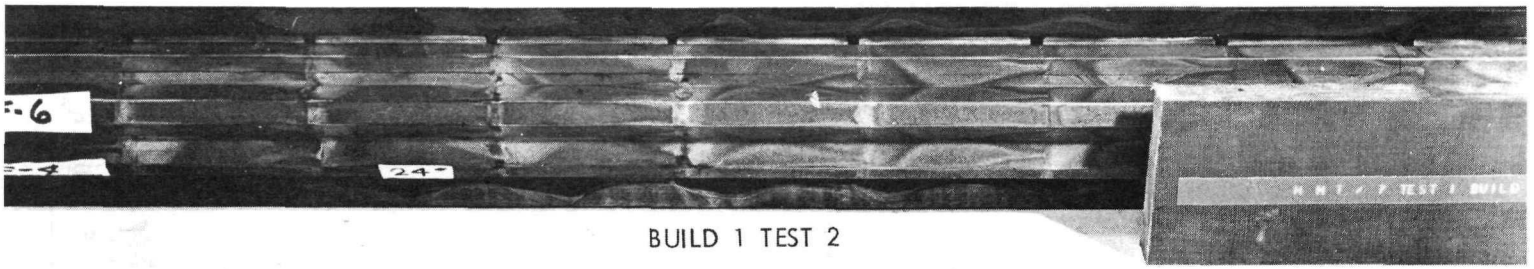
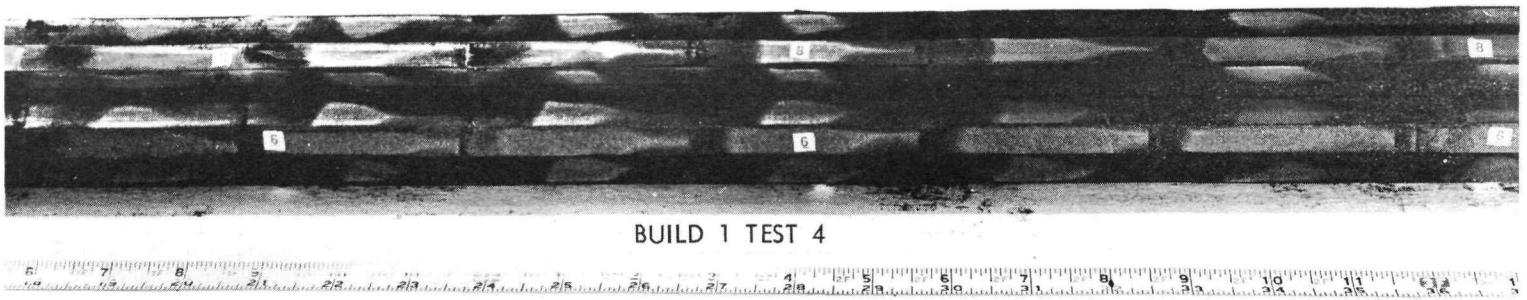
Atomic Energy Act - 1954



BUILD 1 TEST 2



BUILD 1 TEST 4

COMPARISON OF TYPICAL FLOW AND CORROSION PATTERNS OBTAINED UNDER NRX-A TYPE FILLER STRIP ASSEMBLIES

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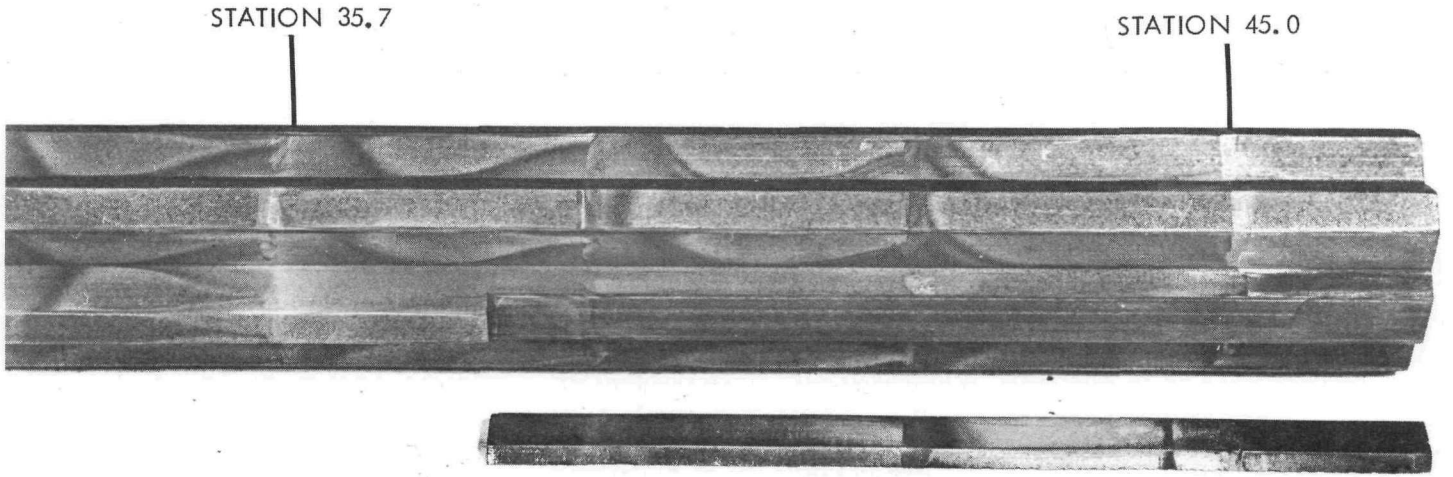
BUILD 1 TEST 2



VIEW OF THE HOT END OF CORE SHOWING TEST SPECIMEN

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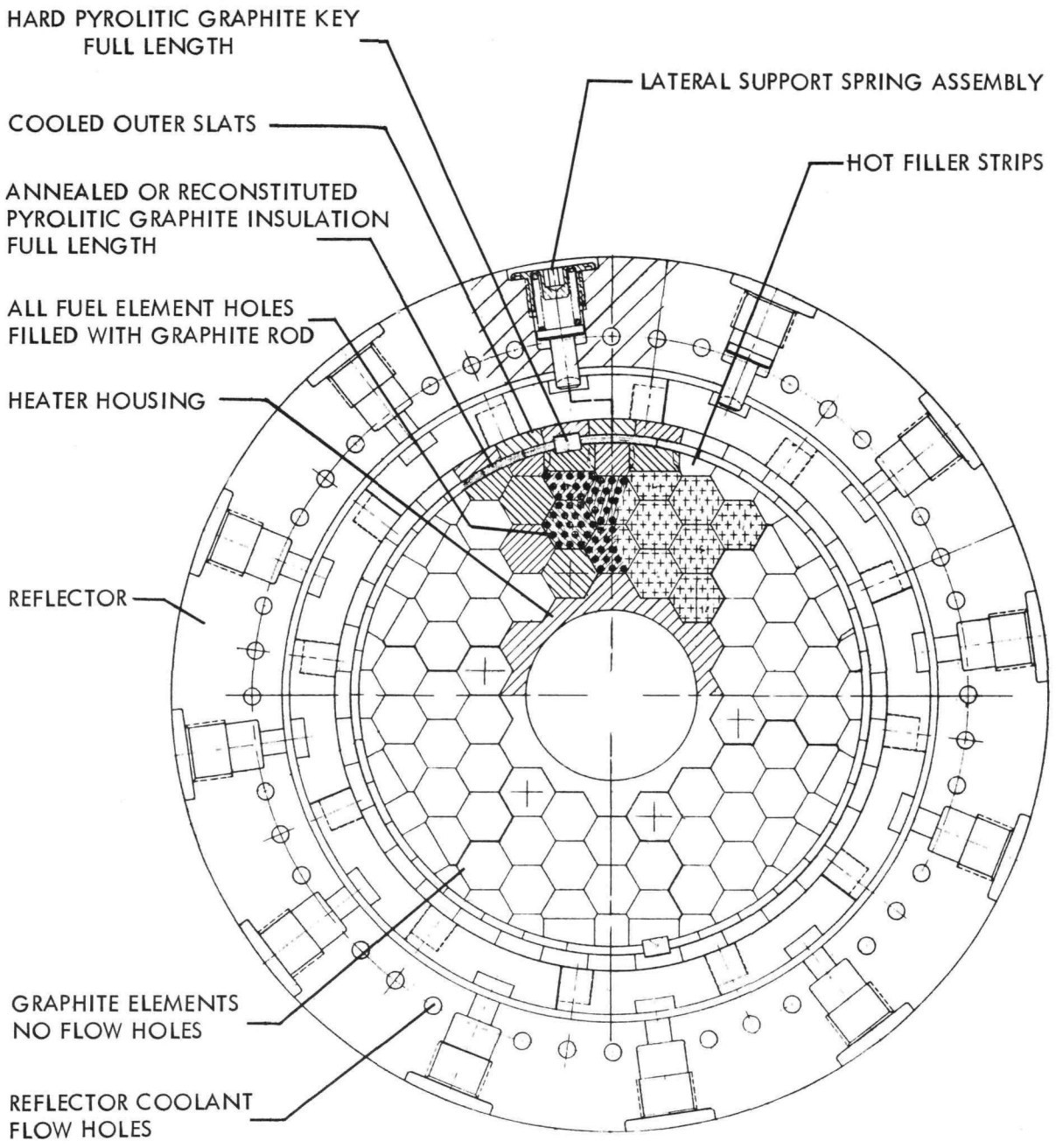
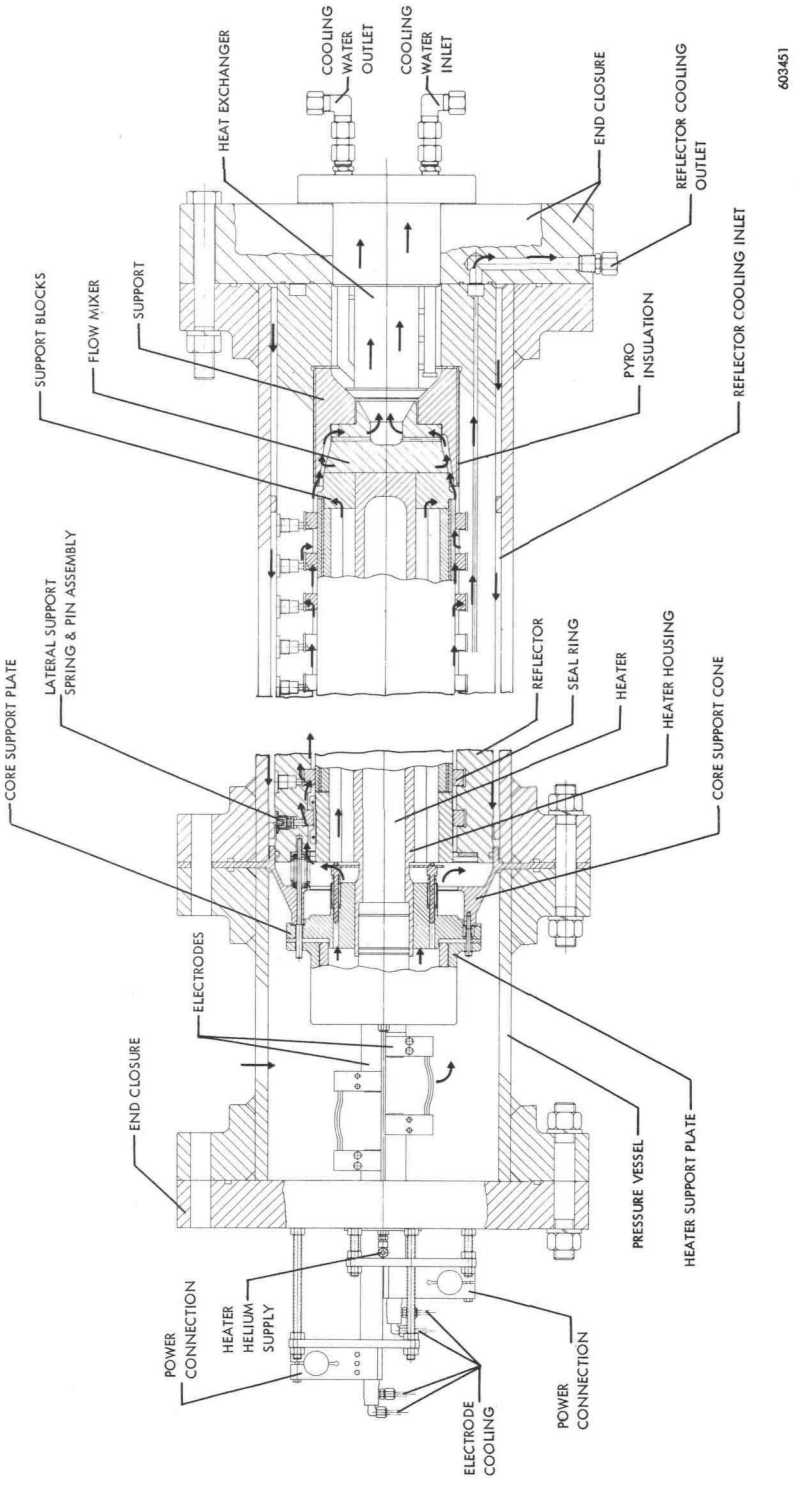
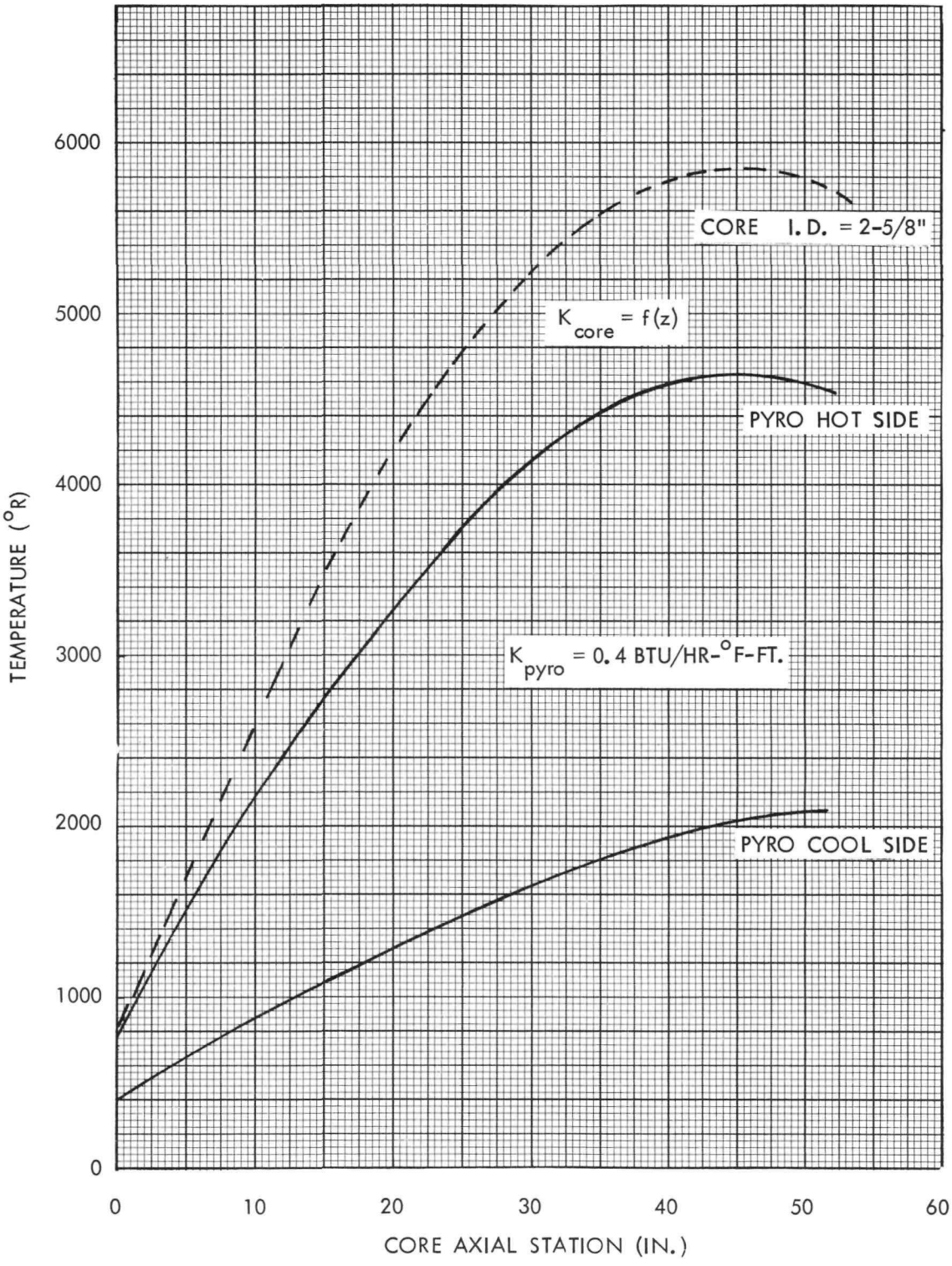
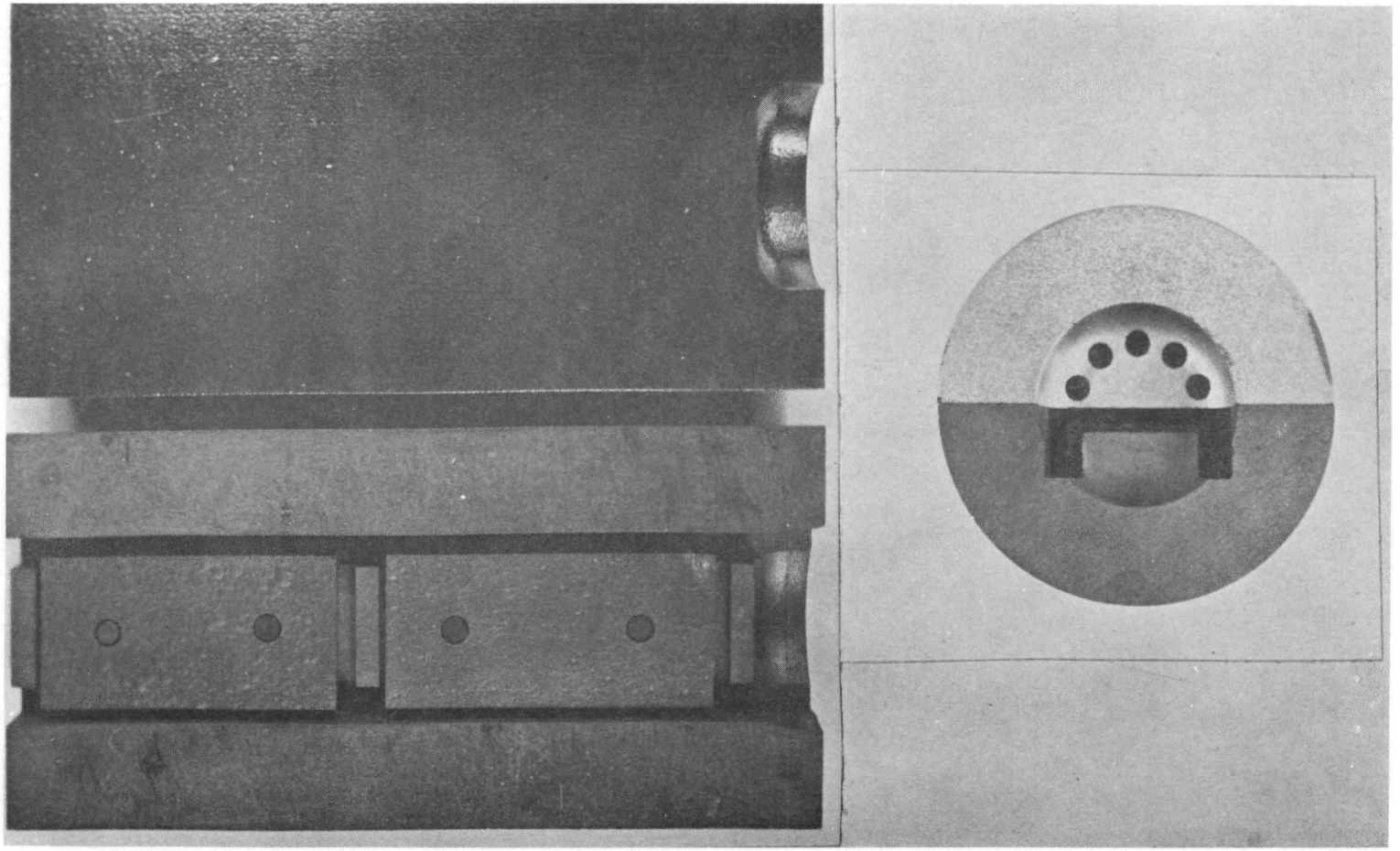


603452

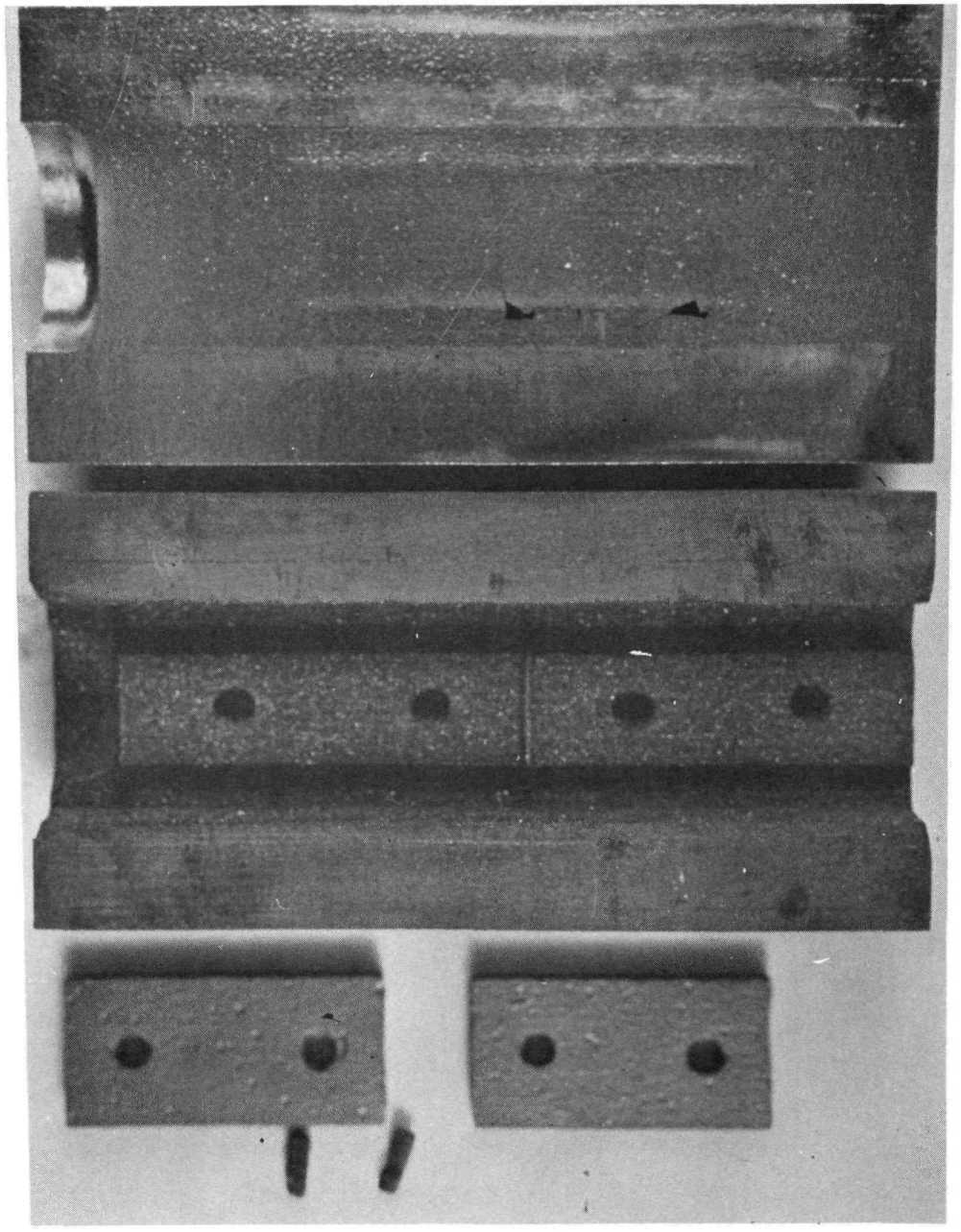
HHT-15 MULTIPLE CLUSTER THERMAL TEST
CROSS SECTION OF MODEL


603451
HEAT EXCHANGER
COOLING WATER OUTLET
COOLING WATER INLET
END CLOSURE
REFLECTOR COOLING OUTLET
SUPPORT BLOCKS
FLOW MIXER
SUPPORT
PYRO INSULATION
REFLECTOR COOLING INLET
LATERAL SUPPORT SPRING & PIN ASSEMBLY
CORE SUPPORT PLATE
REFLECTOR
SEAL RING
HEATER
HEATER HOUSING
CORE SUPPORT CONE
ELECTRODES
END CLOSURE
PRESSURE VESSEL
HEATER SUPPORT PLATE
POWER CONNECTION
HEATER HELIUM SUPPLY
ELECTRODE COOLING
POWER CONNECTION

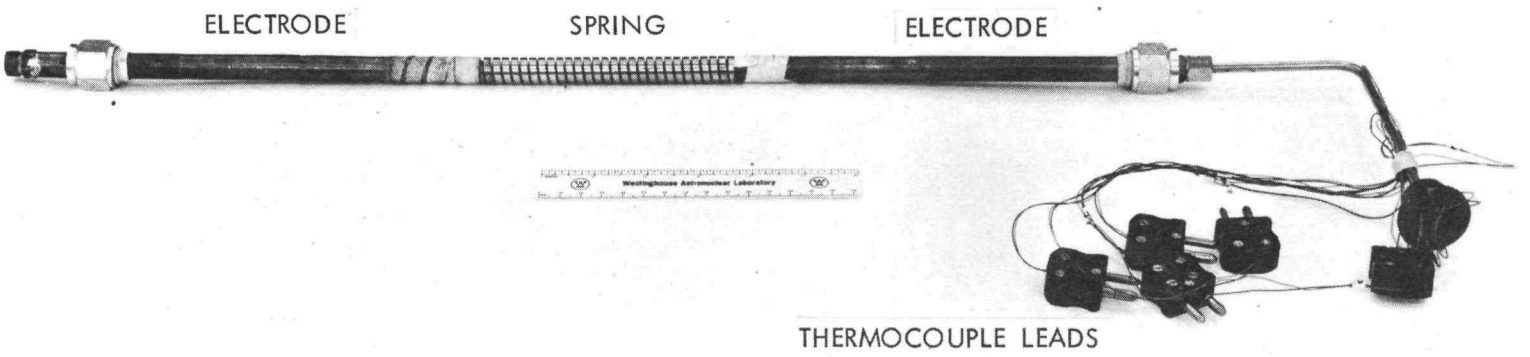


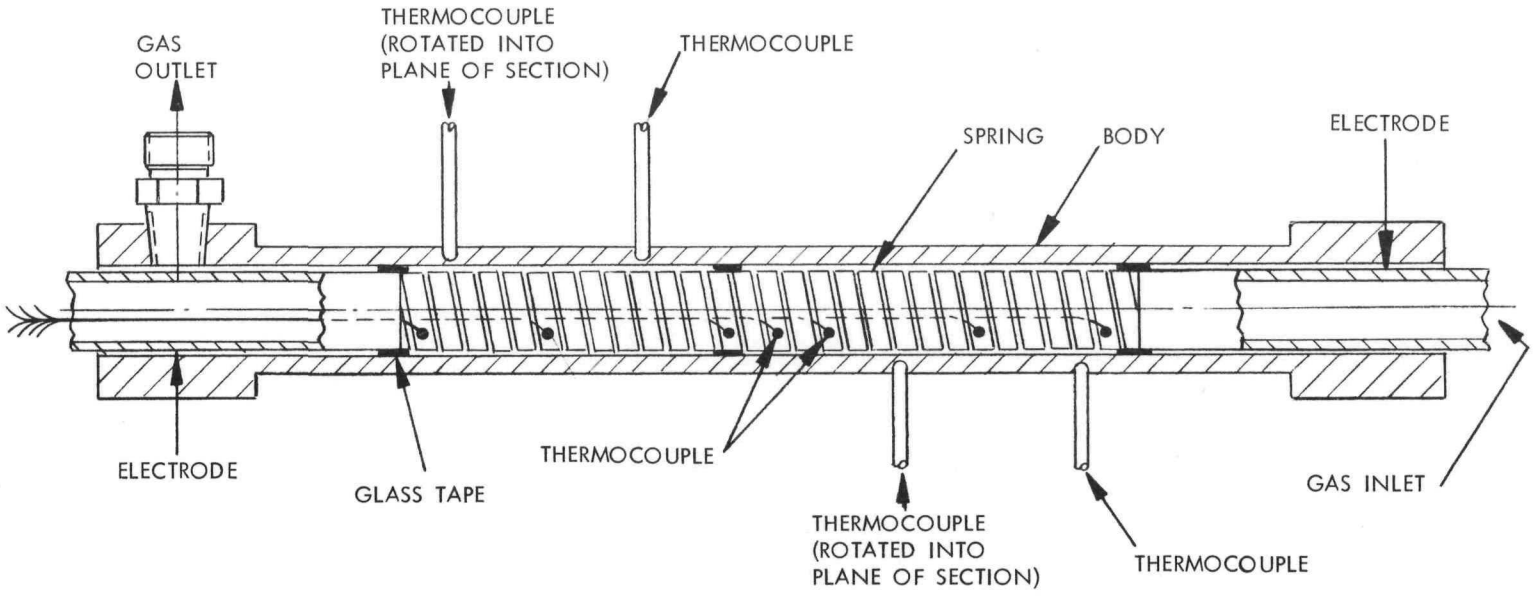


SIMULATED SUPPORT BLOCK AND FILLER STRIP ASSEMBLY

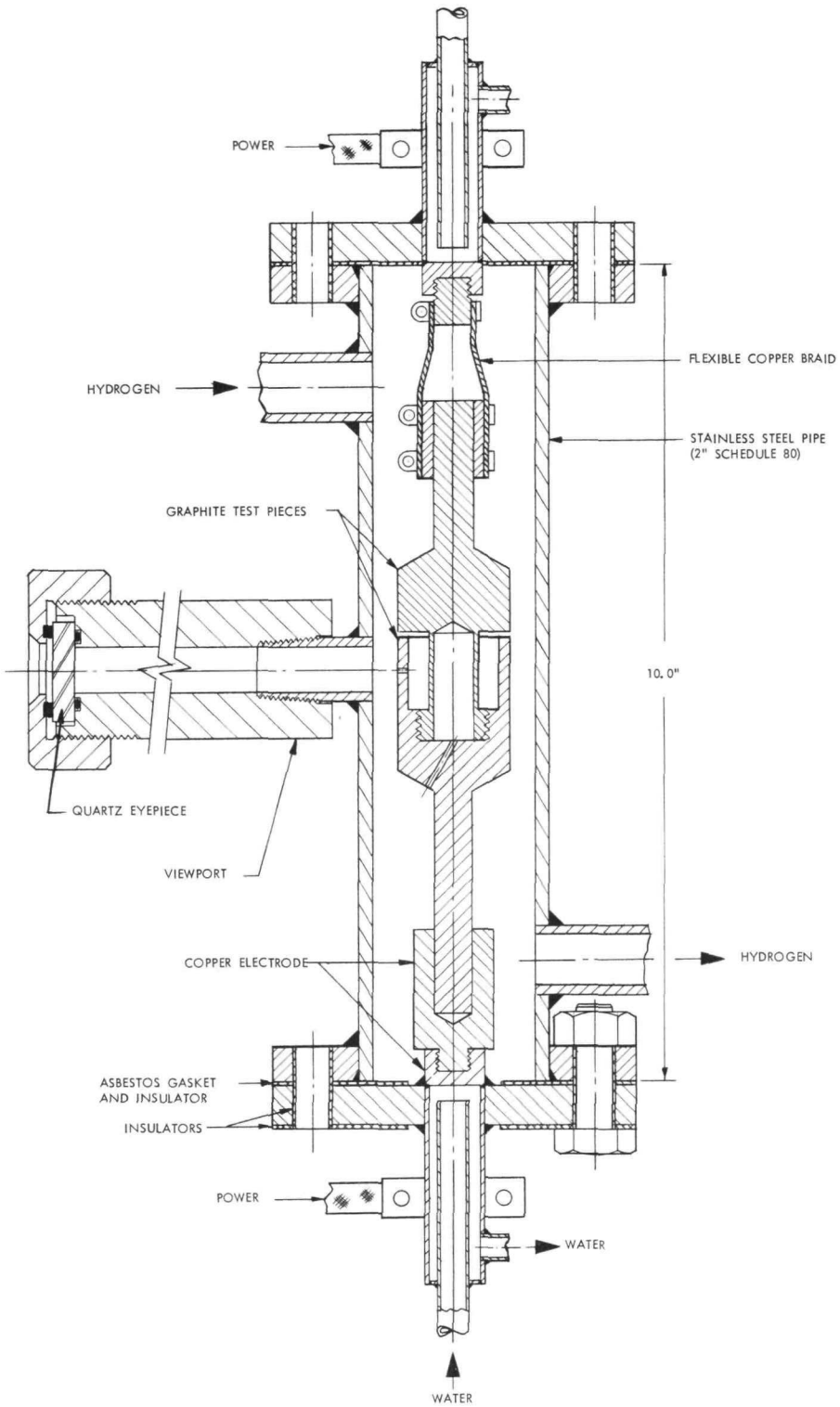


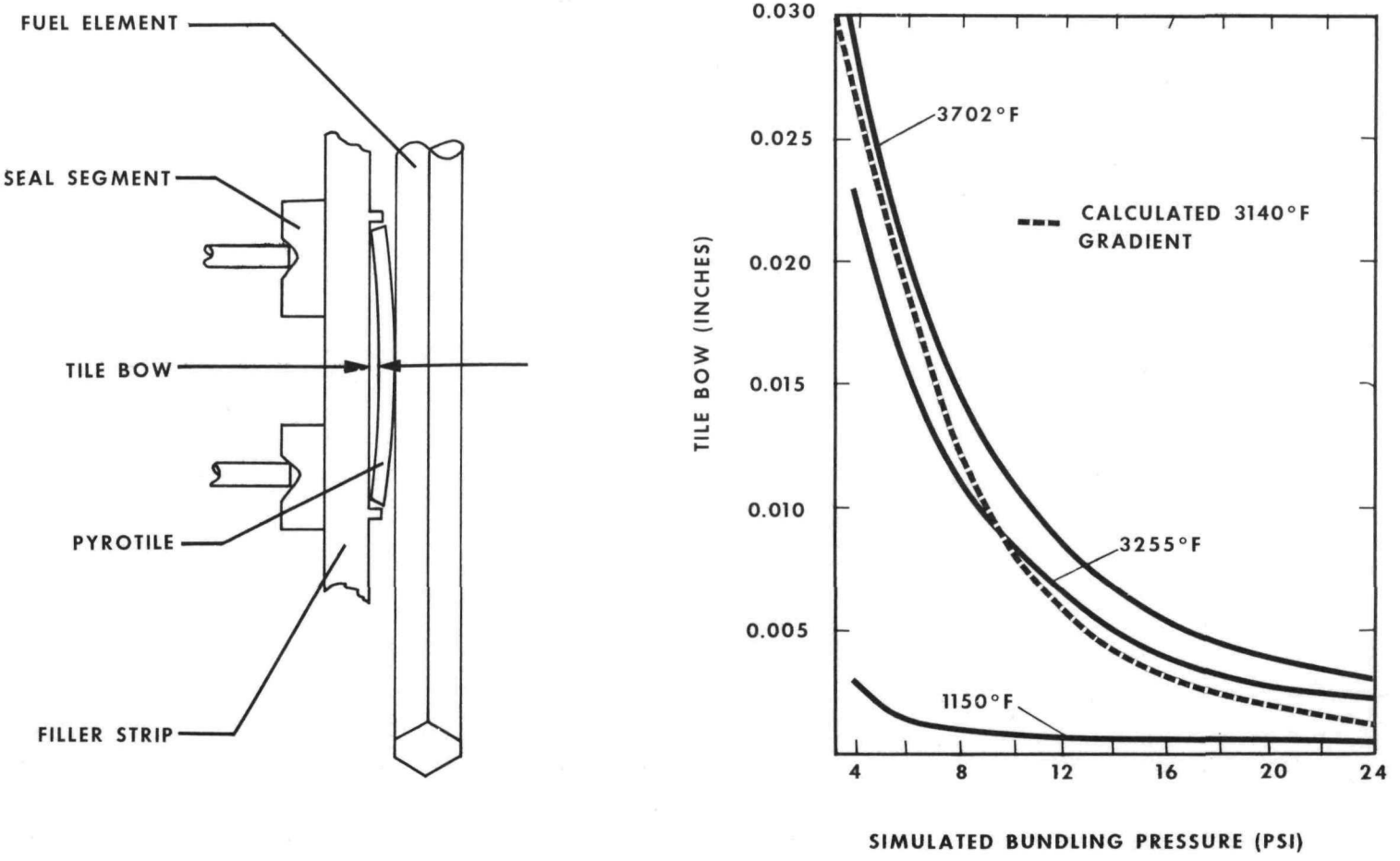
PYROLYTIC GRAPHITE PINS FOR TILE RETENTION





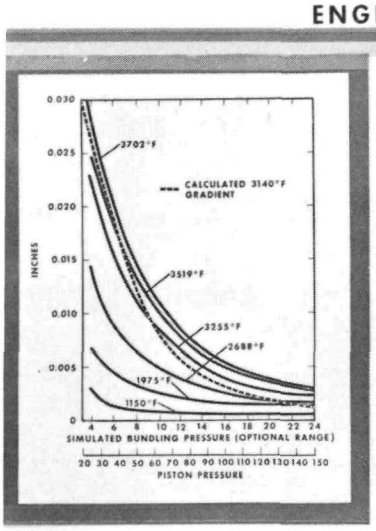
HOT SPRING TEST SPECIMEN


POWER
HYDROGEN
FLEXIBLE COPPER BRAID
STAINLESS STEEL PIPE
(2" SCHEDULE 80)
GRAPHITE TEST PIECES
10.0"
QUARTZ EYEPIECE
VIEWPORT
COPPER ELECTRODE
HYDROGEN
ASBESTOS GASKET
AND INSULATOR
INSULATORS
POWER
WATER
WATER

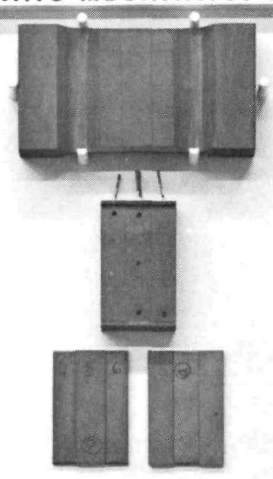


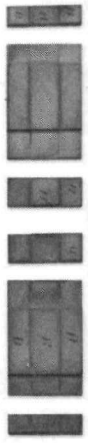
CORE INSULATION BOW TEST 603800D

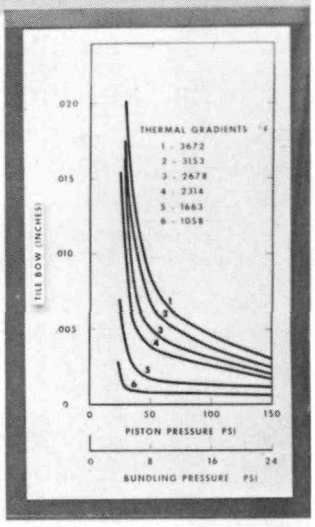
ENGINEERING MECHANICS LABORATORY



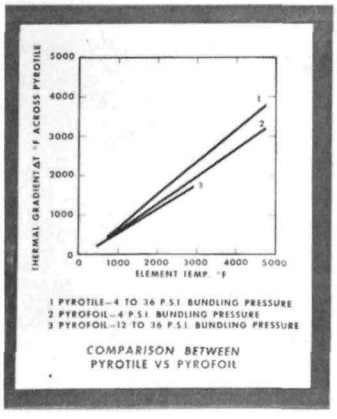
A2-A4 TILE BOW TEST

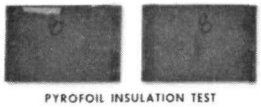




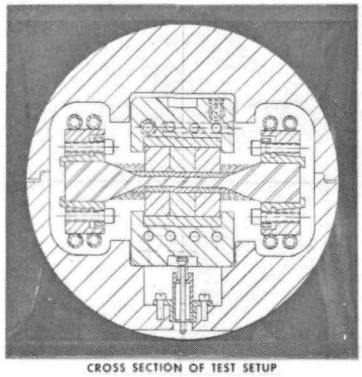


A3-A4 TILE BOW TEST

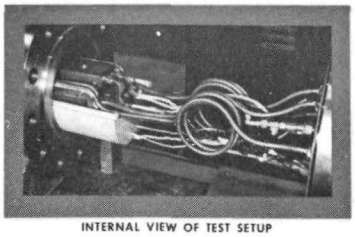




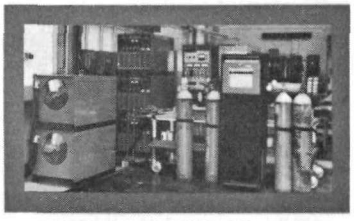
PYROFOIL INSULATION TEST



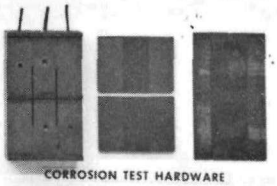
CROSS SECTION OF TEST SETUP



INTERNAL VIEW OF TEST SETUP



CORE INSULATION THERMAL TEST FACILITIES



CORROSION TEST HARDWARE

CORE INSULATION THERMAL TESTS

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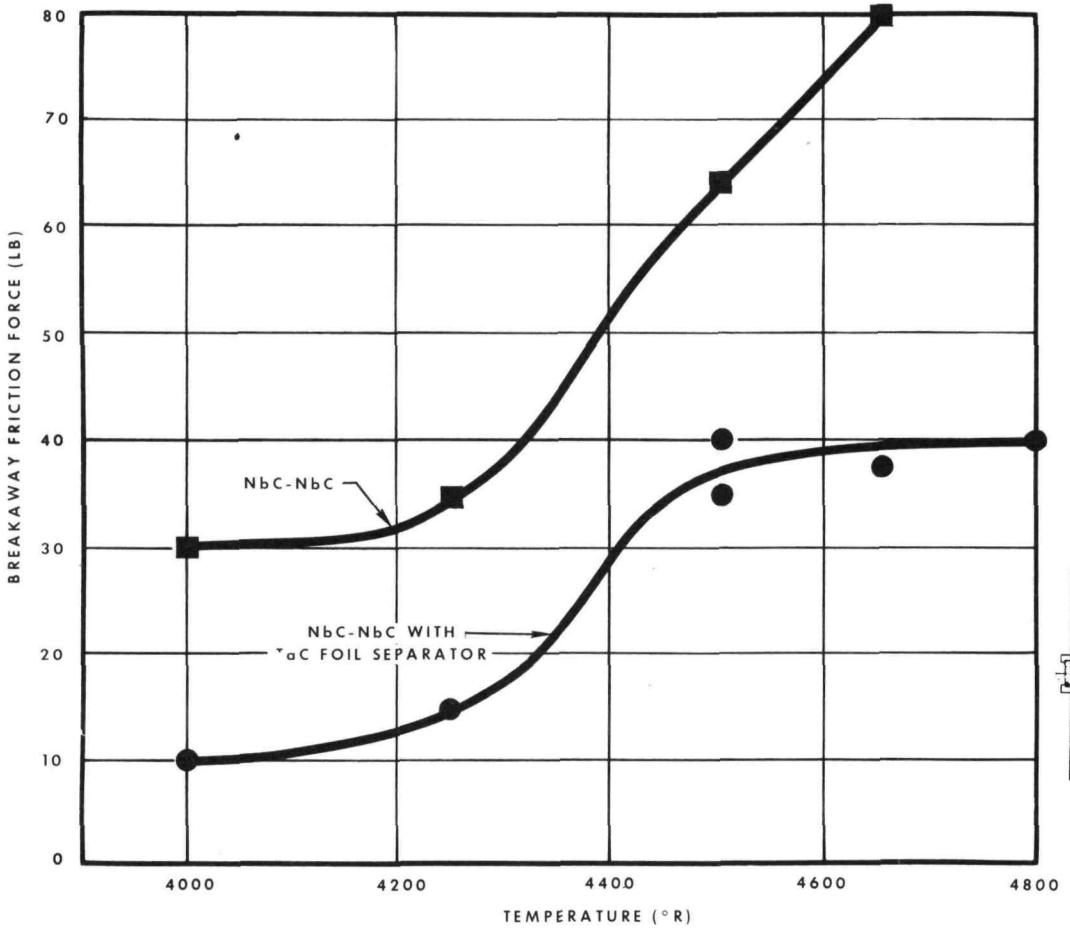
CORE PERIPHERY INTERFACE RELATIVE MOTION TESTS

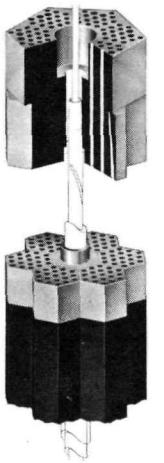
Test Temperature: 4500°R
Contact Pressure: 15 psi
Time At Temperature: 10 min - 3 Cycles
Relative Displacement: 0.25 in.

INTERFACE	COEFFICIENT OF FRICTION	SURFACE CONDITION
ZrC COATED F. E. - PYROTILE	1.3	SOME COATING LOST
ZrO_2 COATED F. E. - PYROTILE	4.8	SOME COATING LOST
NbC COATED F. E. - PYROTILE	1.0	NO COATING DAMAGE
UNCOATED F. E. - PYROTILE	0.3	F. E. SURFACE CORRODED
NbC COATED F. E. - NbC COATED F. E.	2.6	NO COATING DAMAGE
NbC COATED F. E. - UNCOATED F. E.	4.5	F. E. SURFACE CORRODED
UNCOATED F. E. - UNCOATED F. E.	0.3	SURFACES CORRODED

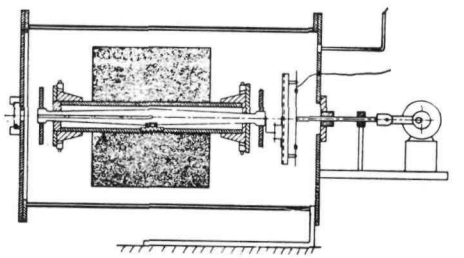
CONTACT FORCE: 20 LB.
CONTACT PRESSURE: 250 PSI
TIME AT TEMPERATURE: 10 MIN.



FUEL ELEMENT SUPPORT BLOCK INTERFACE
BONDING AND COATING WEAR TESTS



FUEL ELEMENT CLUSTER-
SUPPORT BLOCK INTERFACE



SCHEMATIC OF TEST SETUP

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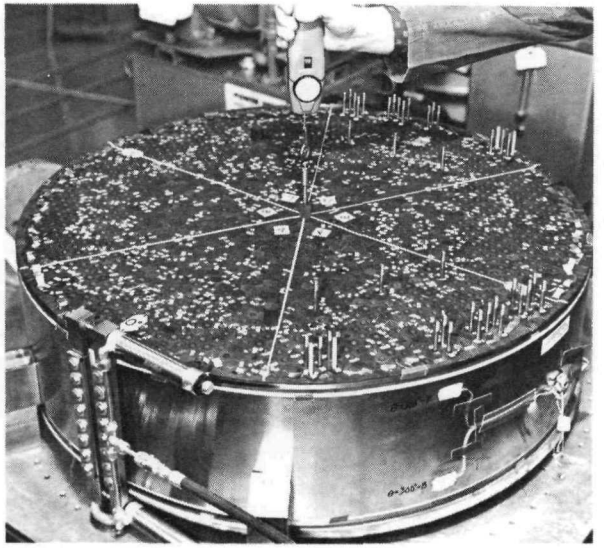
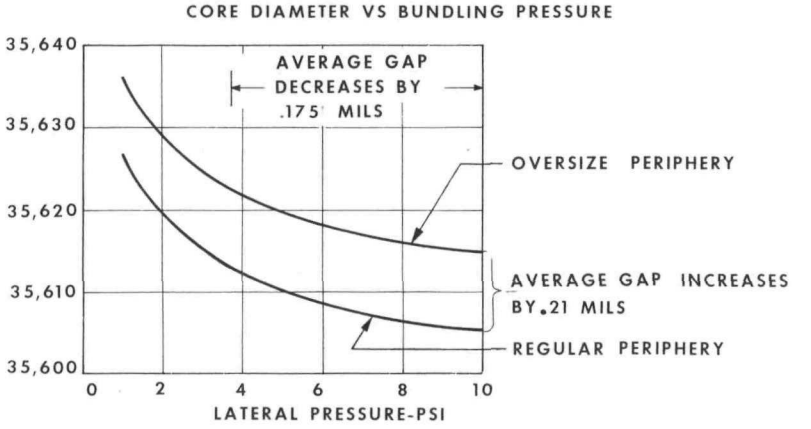
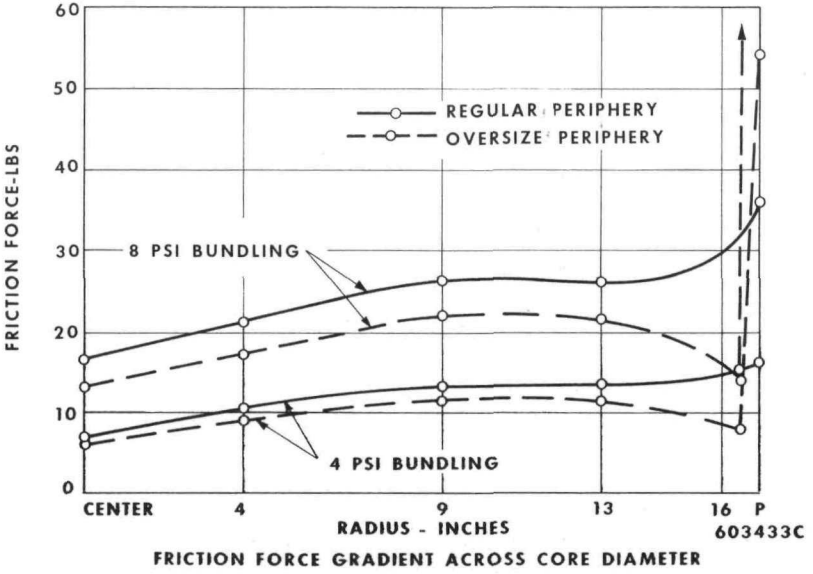
EFFECT OF COATED PERIPHAL ELEMENTS ON CORE PACKING



TEST SETUP





FRICTION FORCE GRADIENT ACROSS CORE DIAMETER

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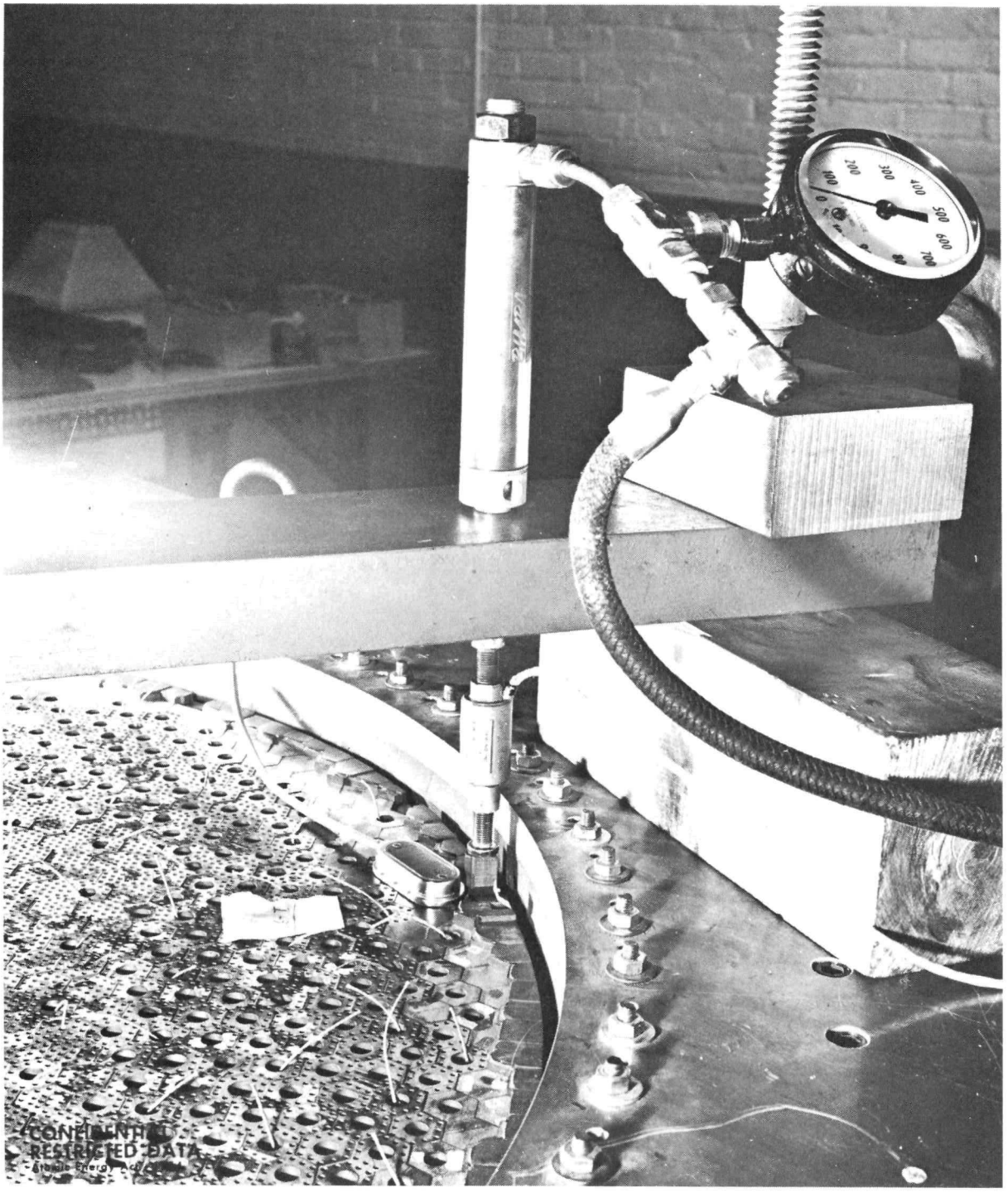
0
100
200
300
400
500
600
700
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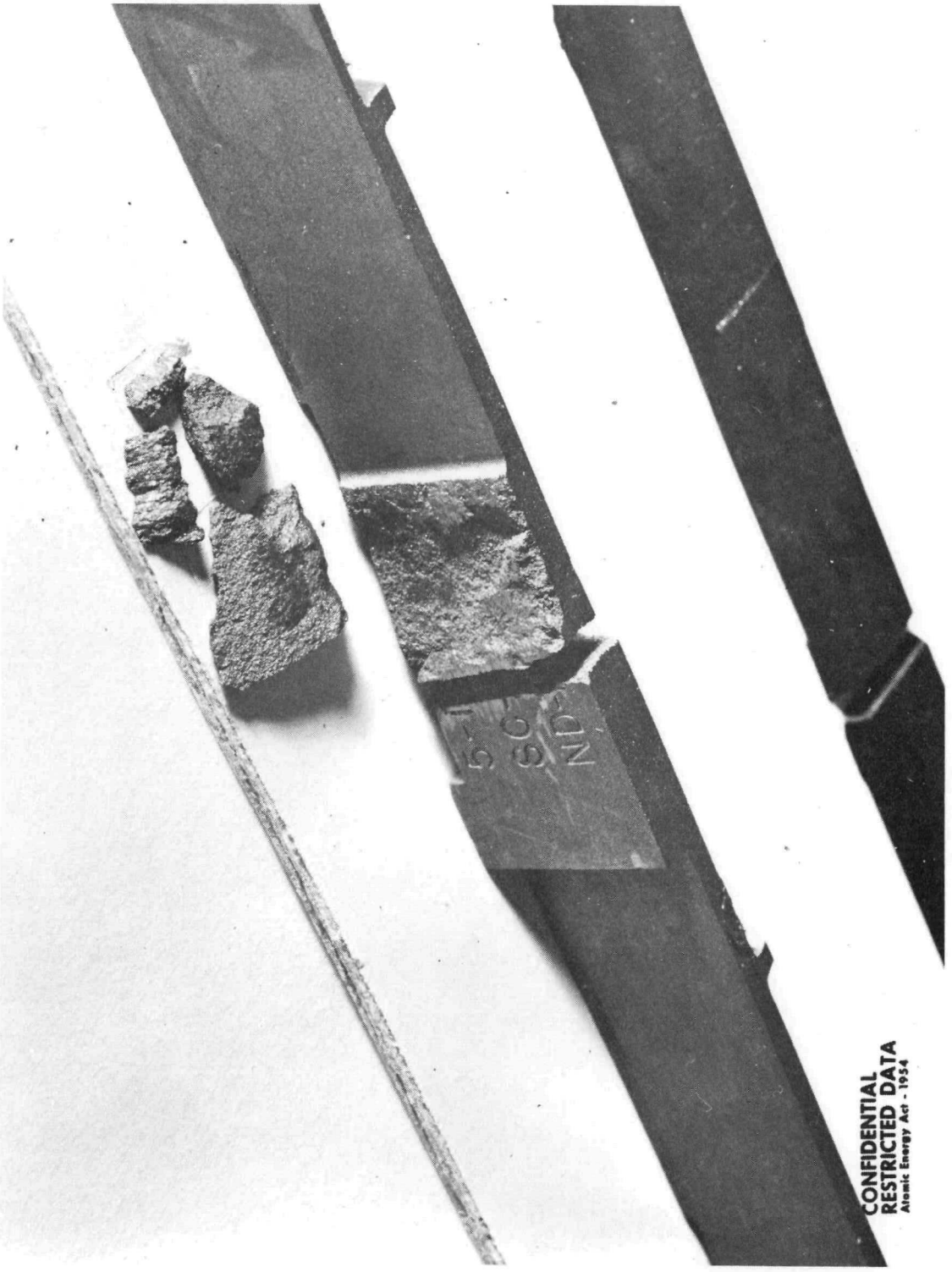

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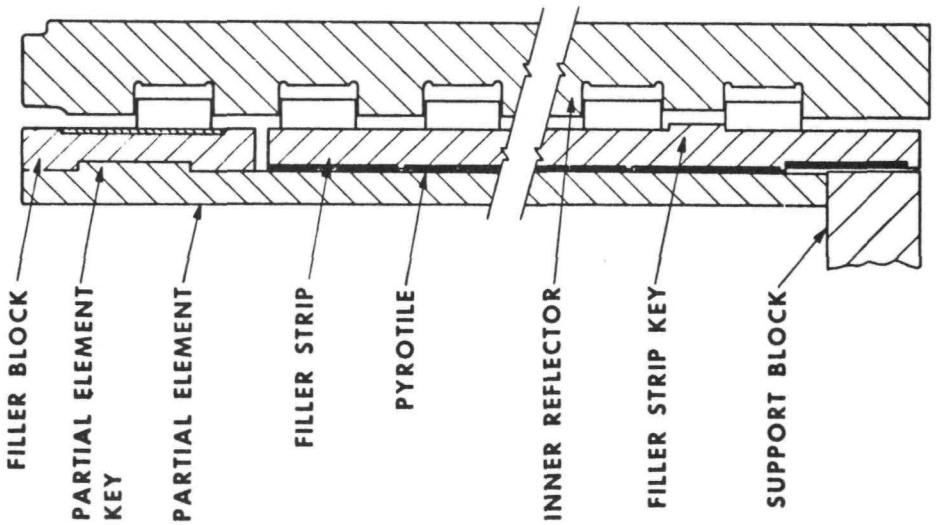
Atomic Energy Act - 1954

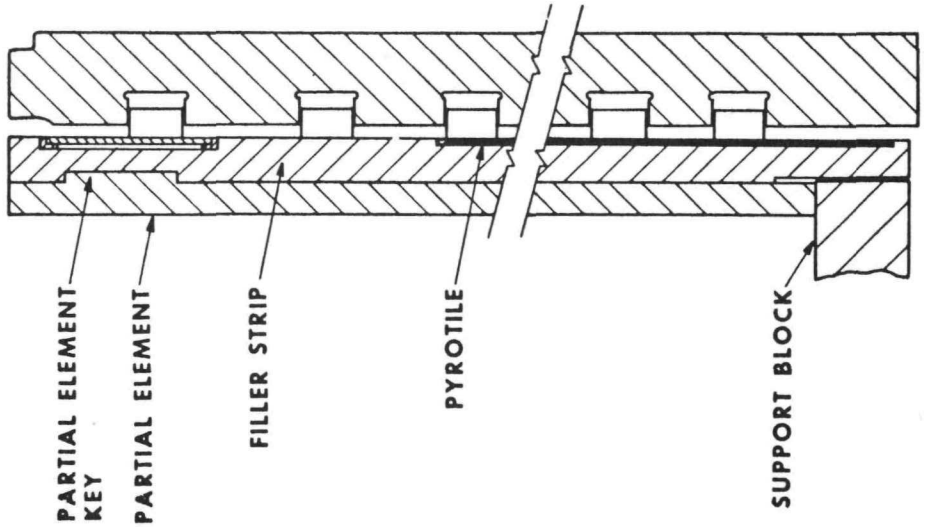
SUMMARY OF FILLER STRIP TEST RESULTS

FILLER STRIP IDENTIFICATION NUMBER	FRACTURE LOAD (LB)
10	650
10	575
10	620
1	560
26	750
6	380
16	750
	612 LB. AVERAGE
DESIGN LOAD CRITERIA	400 LB.

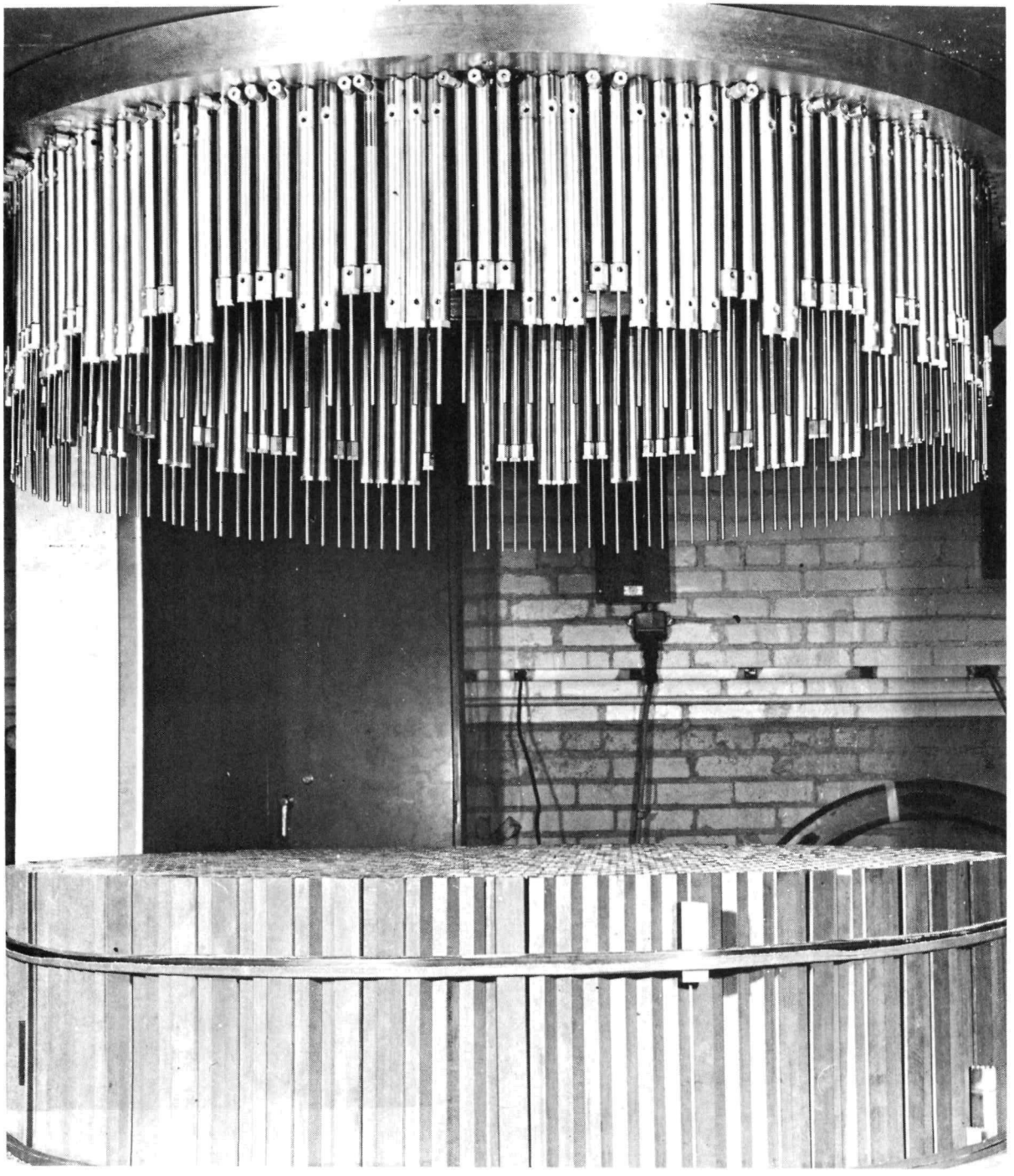
CORE PERIPHERY

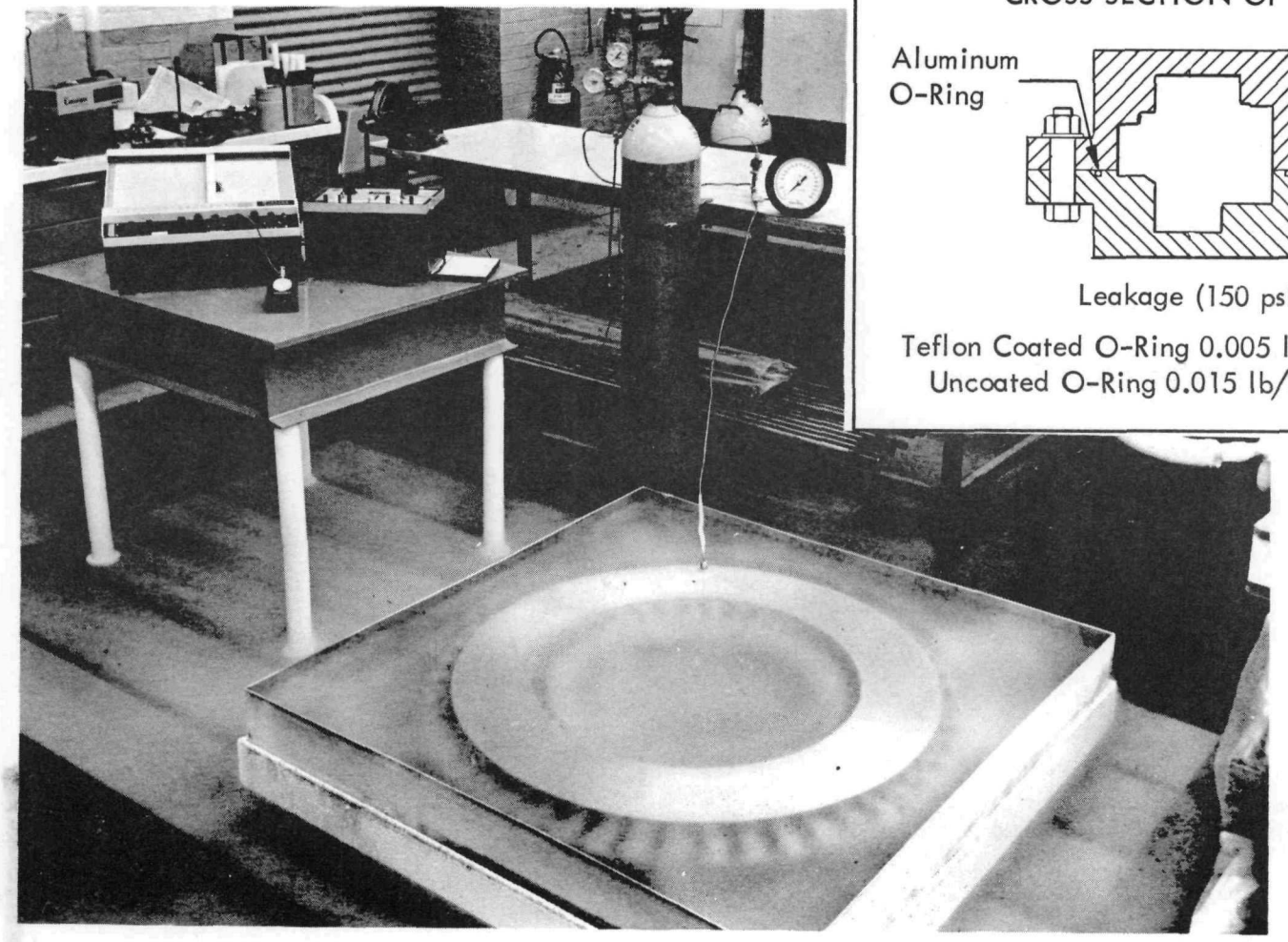


NRX-A3 AND NRX-A4 564398



HOT BUFFER PERIPHERY NRX-A5





CROSS SECTION OF TORUS

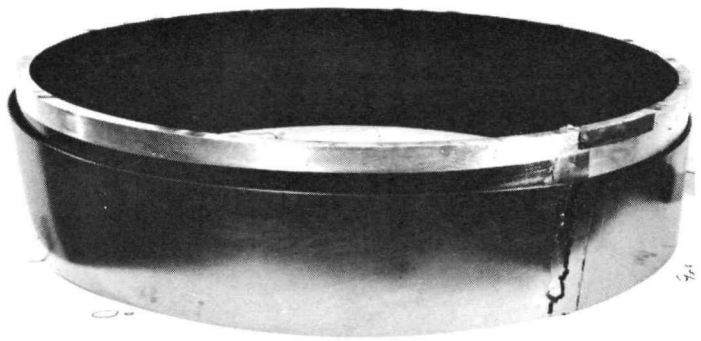
Leakage (150 psig)

Teflon Coated O-Ring 0.005 lb/hr/ft of Seal
Uncoated O-Ring 0.015 lb/hr/ft of Seal

603460

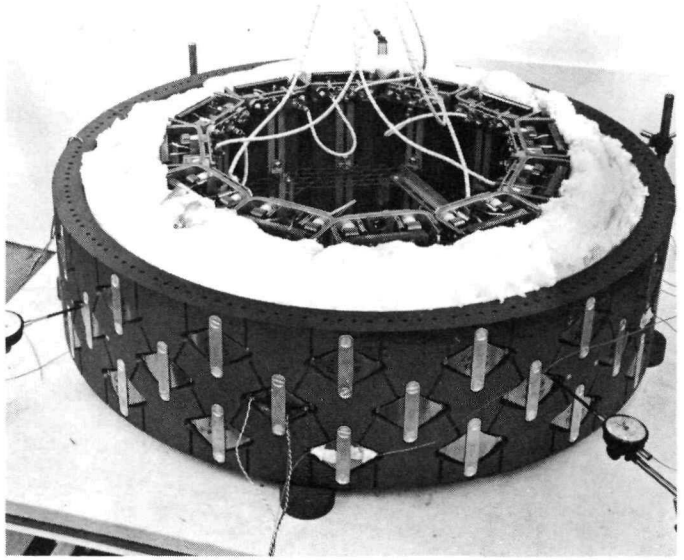
DOME END SEAL TEST RIG TORUS SEAL TEST

PYROFOIL WRAPPER TESTING

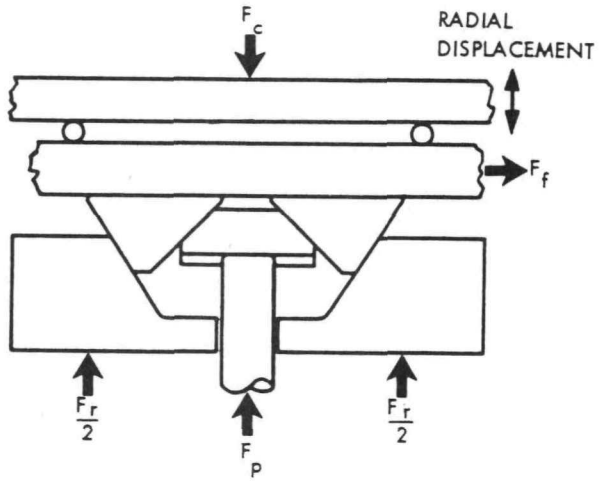


RESULTS OF 1% AVG. STRAIN

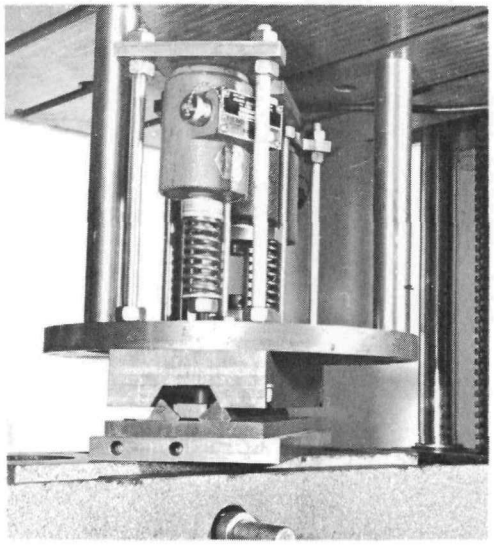
TEST SETUP



603764



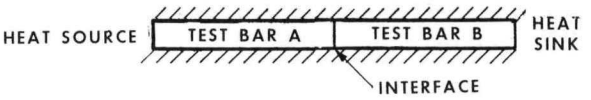
LOADING DIAGRAM

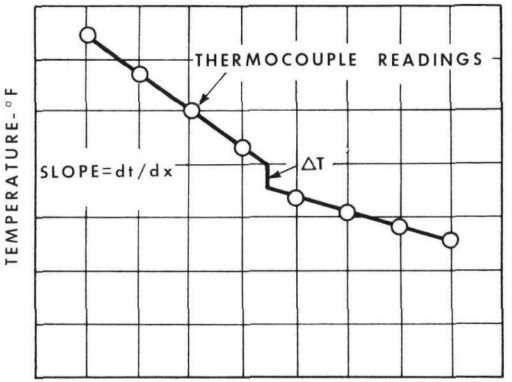


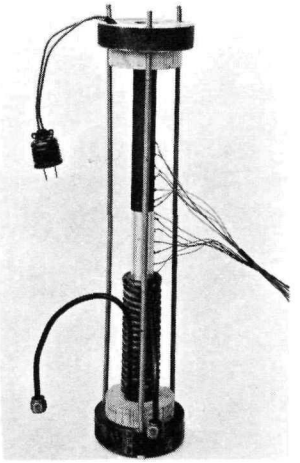
TEST SETUP

CORE PERIPHERY SEAL FRICTION AND LOCKUP TEST

THERMAL CONTACT PROPERTIES TESTING

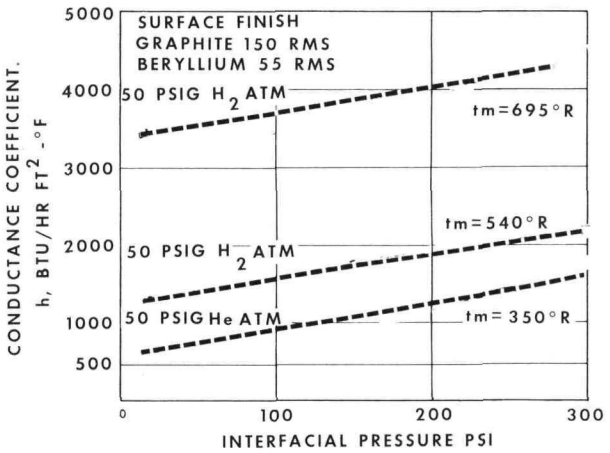






TEST ASSEMBLY

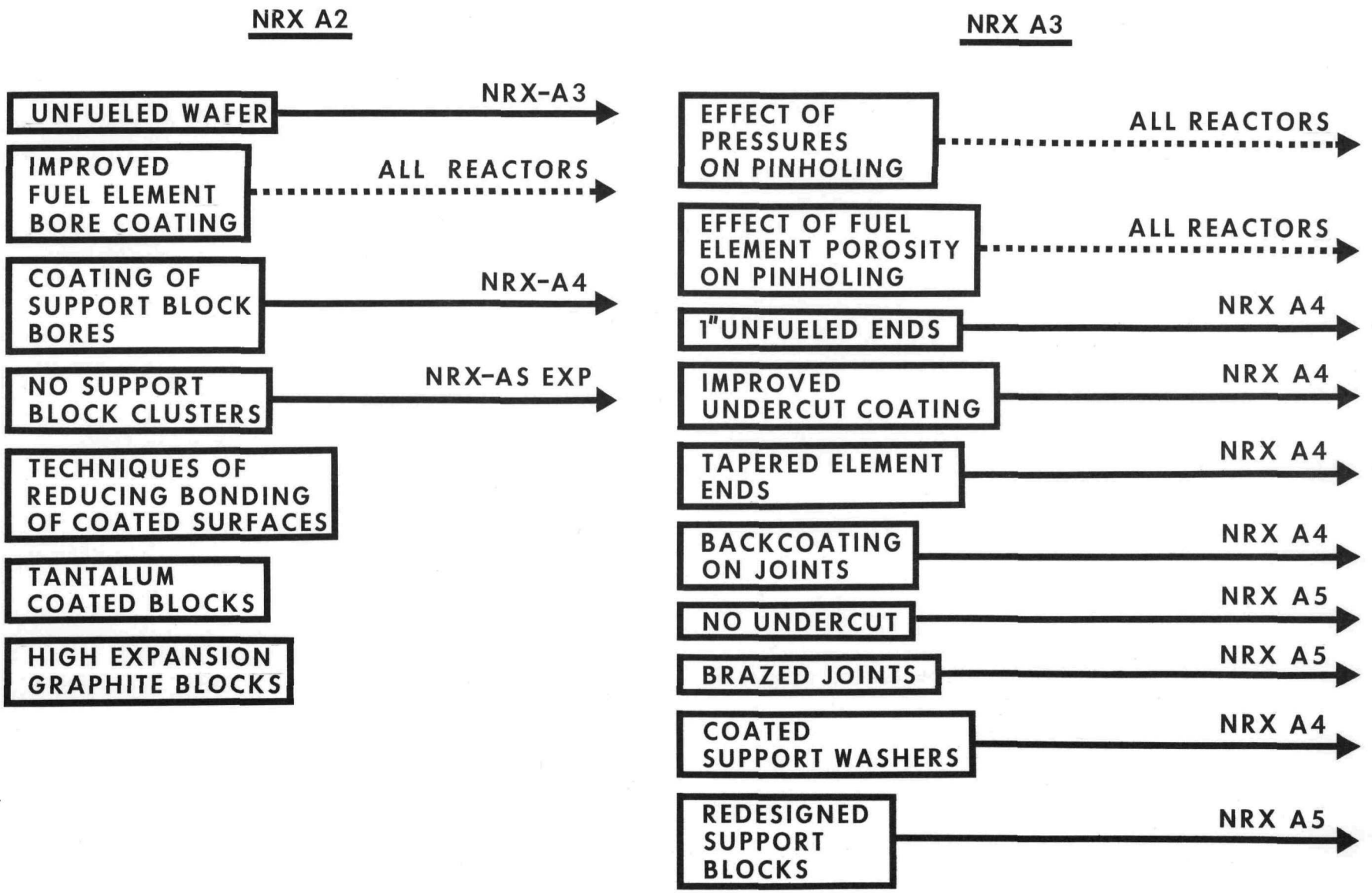
EFFECT OF INTERFACE TEMPERATURE AND CONTACT PRESSURE



THERMAL CONTACT RESISTANCE TESTS				
		TEMP °R	INTERFACIAL PRESS PSI	GAS
1	ALUMINUM GRAPHITE	350	10	H_2
		540	50	
		700	300	He
2	BERYLLIUM GRAPHITE	350	10	H_2
		540	50	
		700	300	He

603434C

FUEL ELEMENT & SUPPORT BLOCK CORROSION



SINGLE ELEMENT HYDROGEN CORROSION TEST SUMMARY
OCTOBER 1, 1964 TO AUGUST 15, 1965

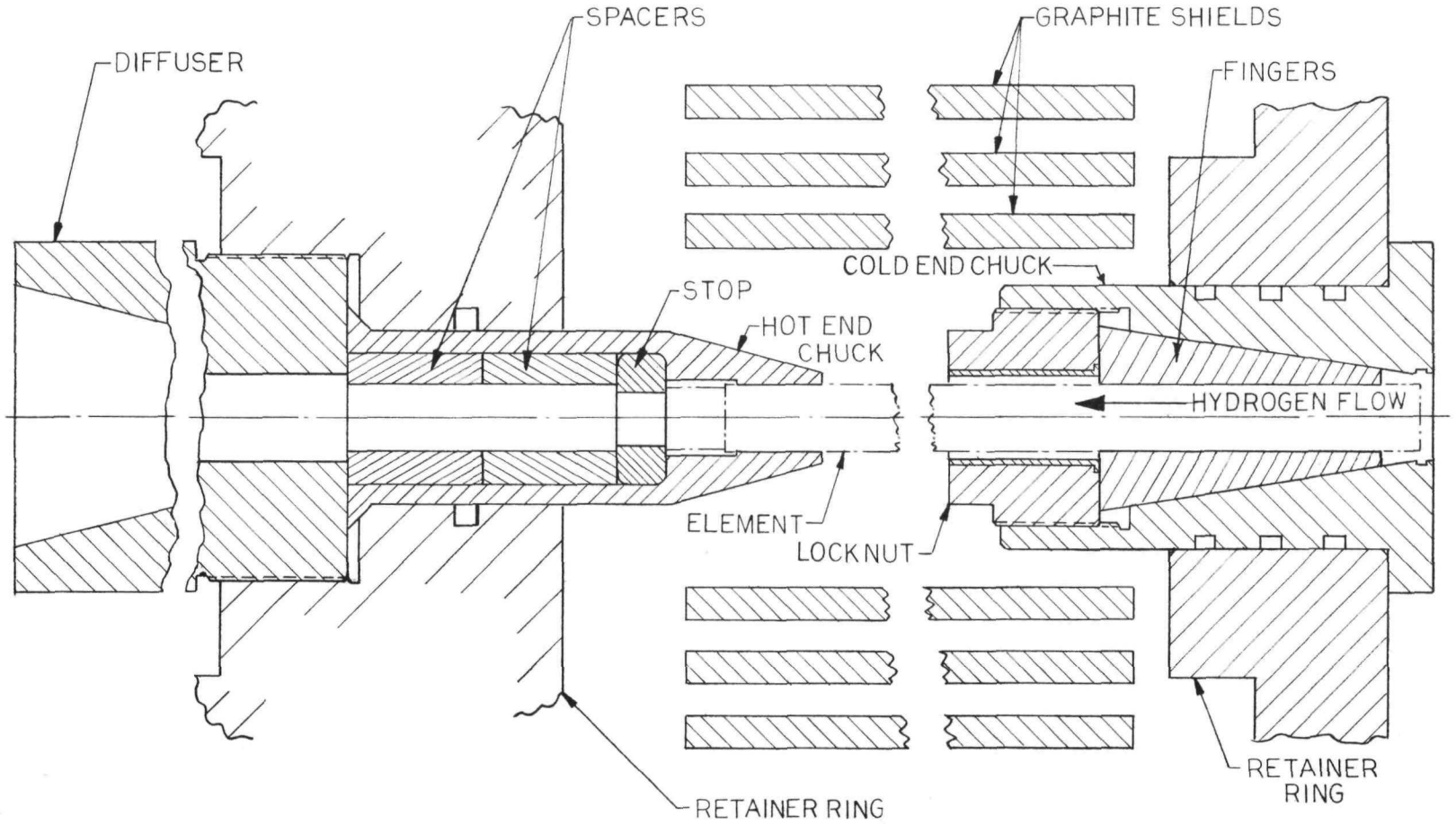
Test	WANL	WANHES	Total
1A5	168	2	170
1A10	1	---	1
1B10	211	82	293
1B5+5	165	194	359
1B15	5	3	8
1B20	131	129	260
1B30	5	18	23
1C10	33	---	33
1C10+10	1	1	2
1C20	37	11	48
1C30	4	---	4
Misc.	35	17	52
Total	796	457	1,253

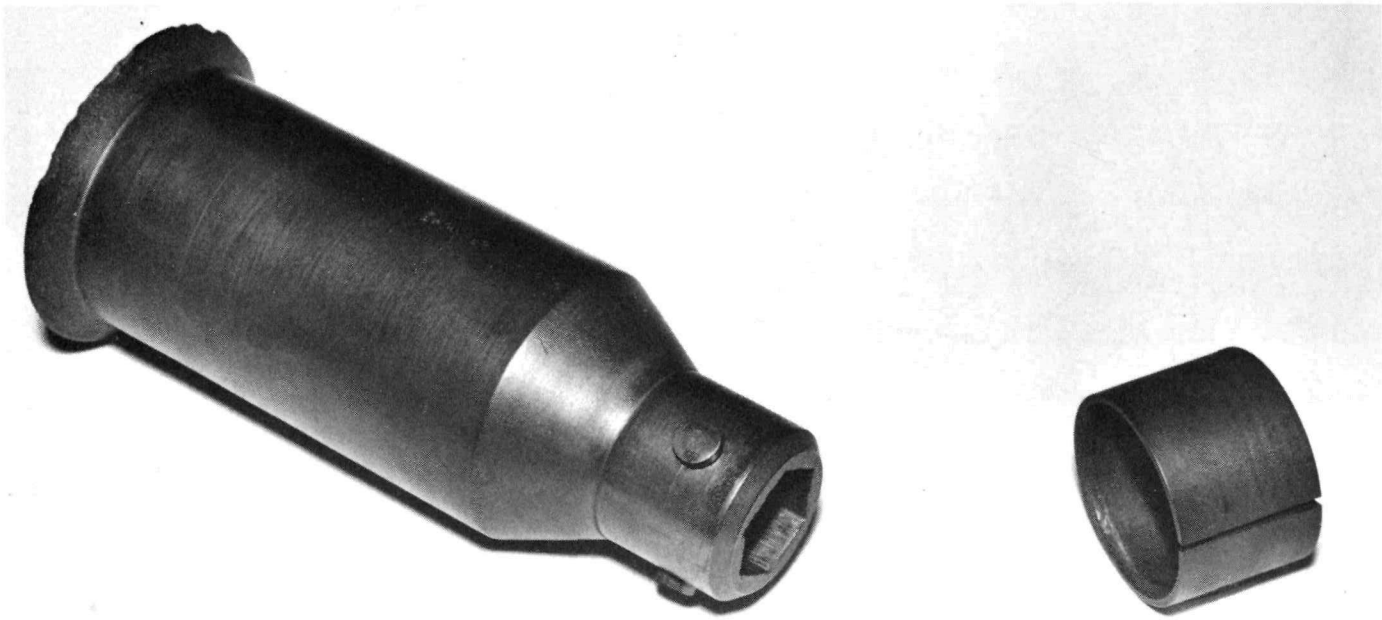
TEMPERATURE CONDITIONS

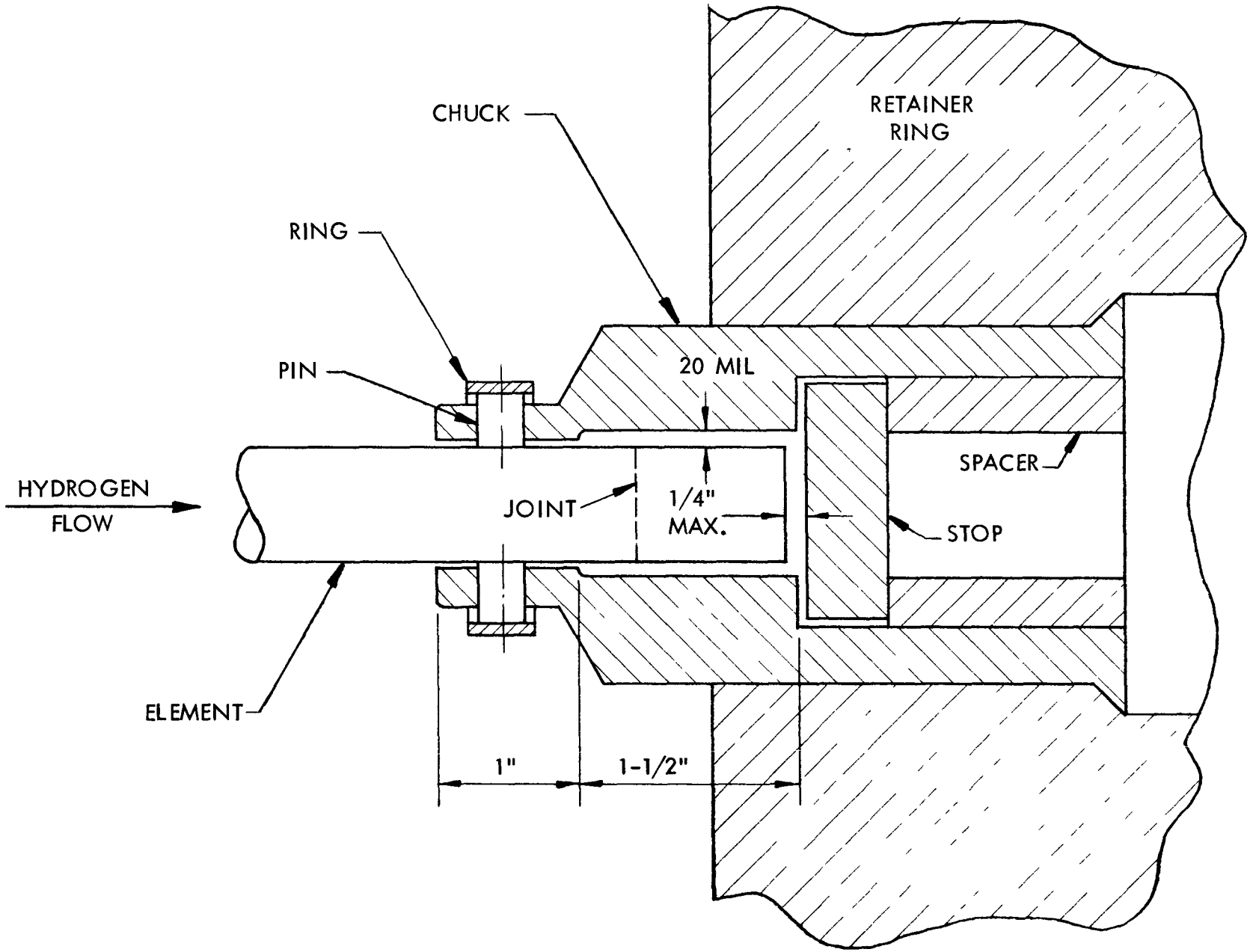
1A = surface temperature 4600°R, int. temp. = 5150

1B = surface temperature 4450°R, int. temp. = 4900

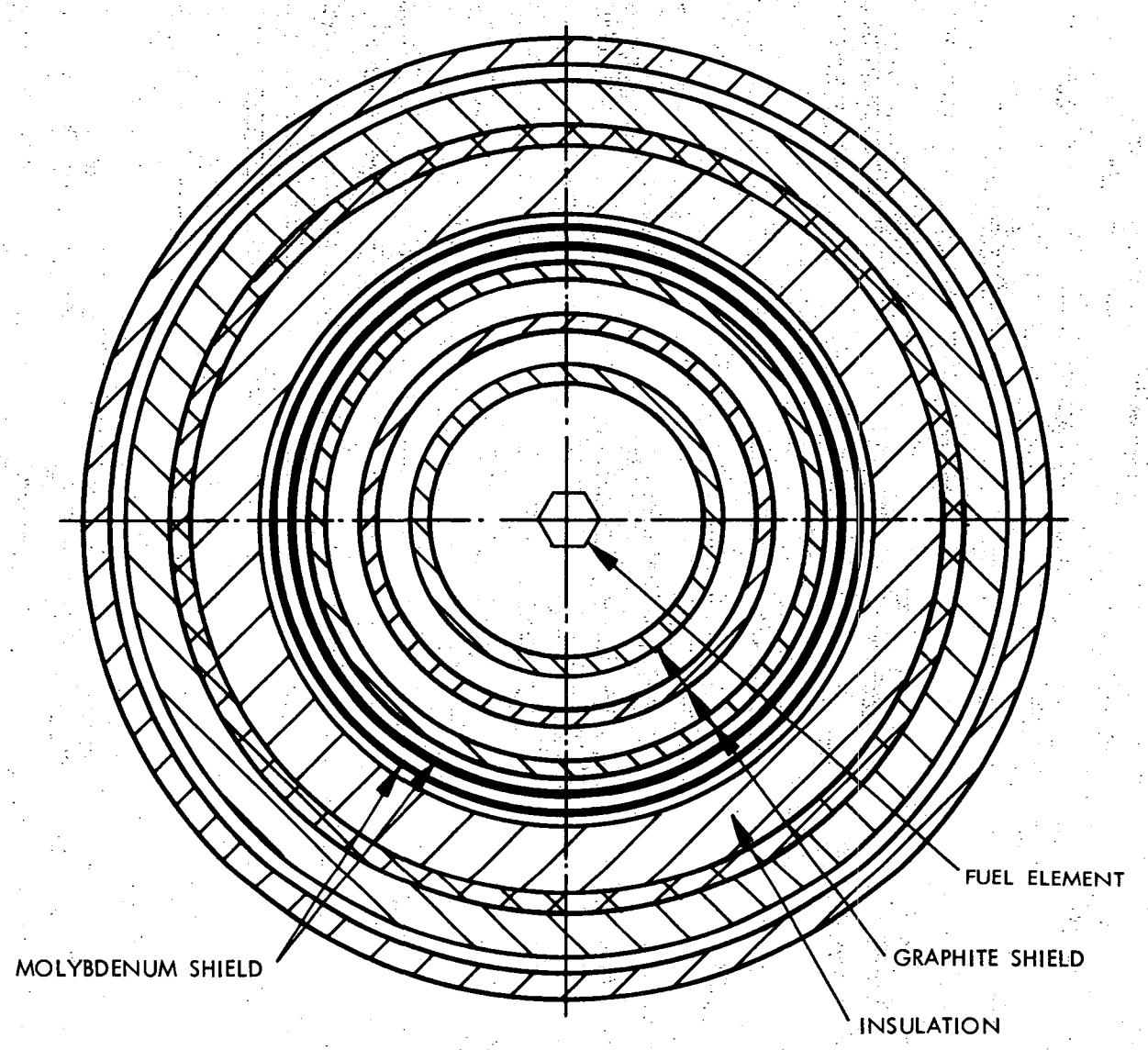
1C = surface temperature 4300°R, int. temp. = 4660


SPACERS
GRAPHITE SHIELDS
DIFFUSER
FINGERS
COLD END CHUCK
STOP
HOT END CHUCK
HYDROGEN FLOW
ELEMENT
LOCK NUT
RETAINER RING
RETAINER RING

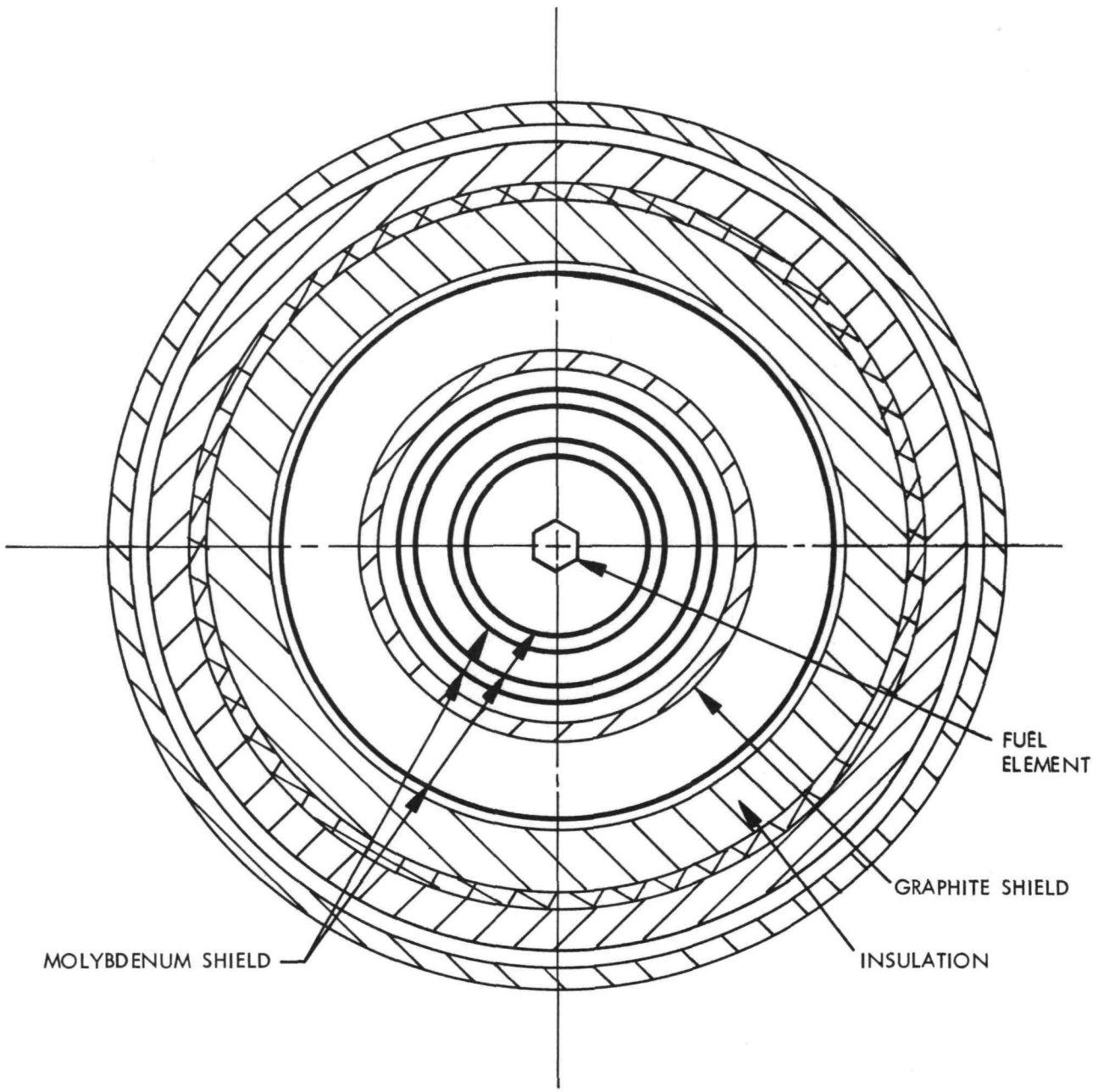




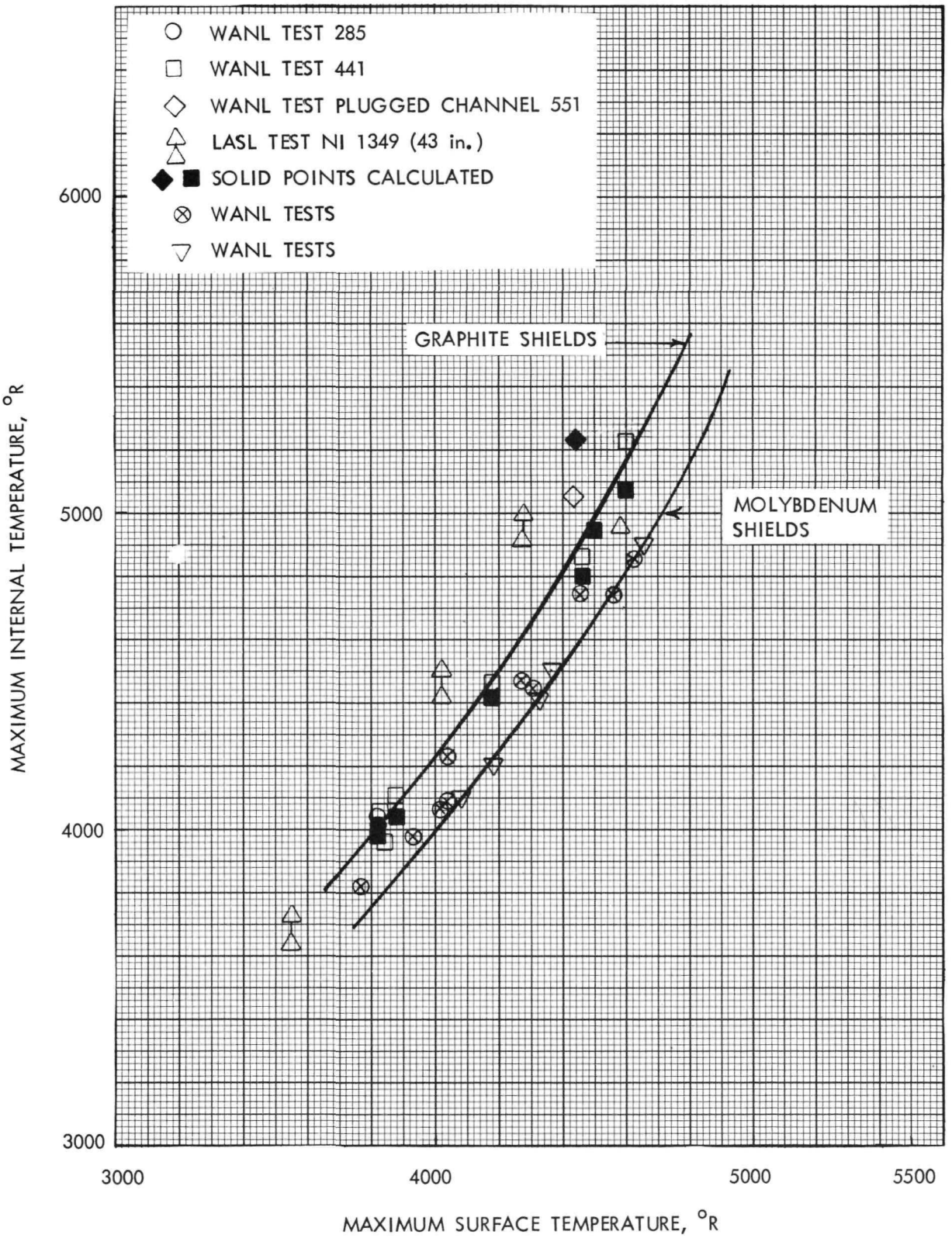
THREE PIN HOT END CHUCK ARRANGEMENT

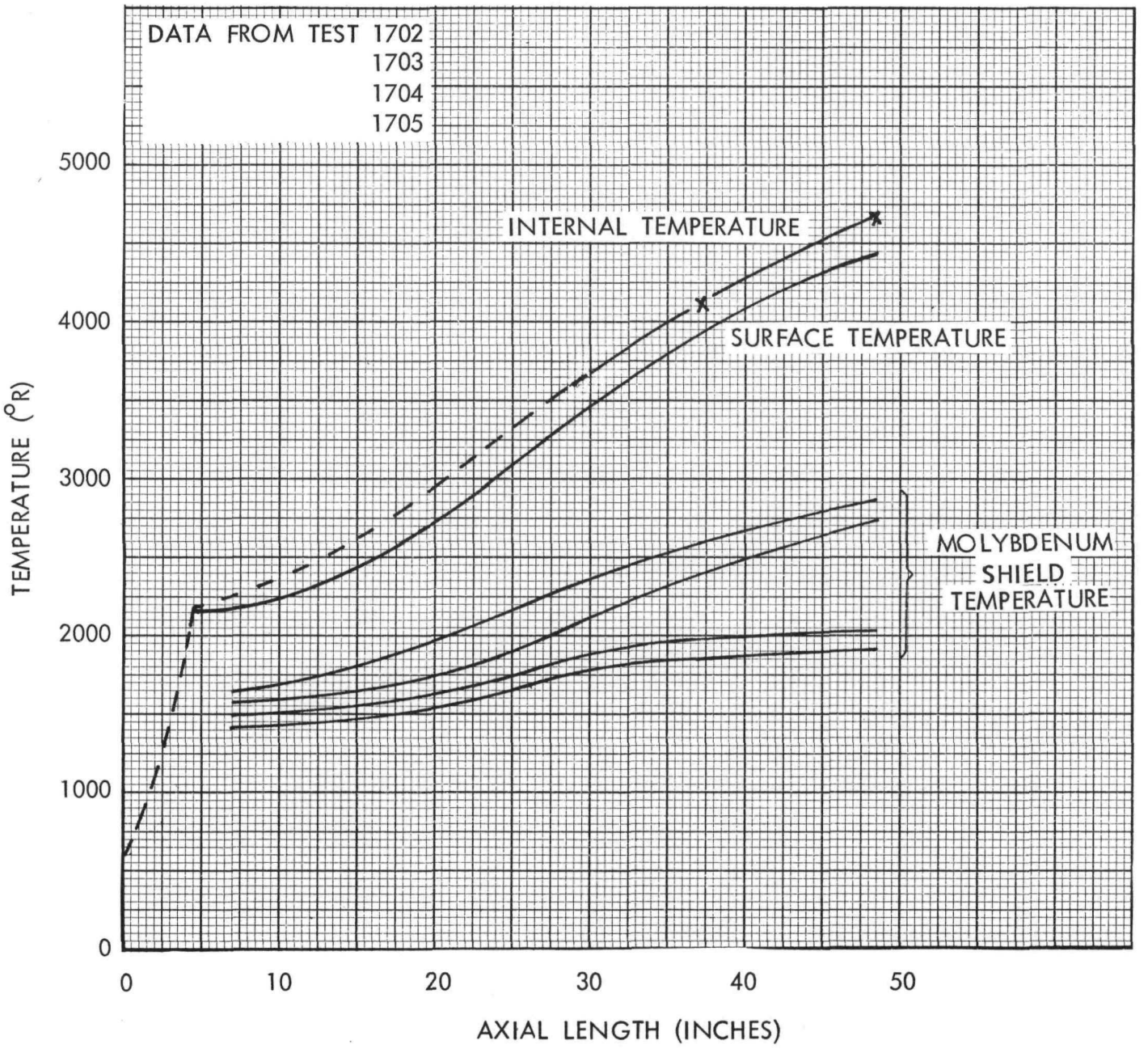


NRX-A2, A3 AND A4 RADIATION SHIELDING GEOMETRY
HYDROGEN CORROSION FURNACE



PROPOSED NRX-A5 RADIATION SHIELDING SCHEMATIC
HYDROGEN CORROSION FURNACE


WANL TEST 285
WANL TEST 441
WANL TEST PLUGGED CHANNEL 551
LASL TEST NI 1349 (43 in.)
SOLID POINTS CALCULATED
WANL TESTS
WANL TESTS
GRAPHITE SHIELDS
MOLYBDENUM SHIELDS
MAXIMUM INTERNAL TEMPERATURE, °R
MAXIMUM SURFACE TEMPERATURE, °R
6000
5000
4000
3000
3000
4000
5000
5500



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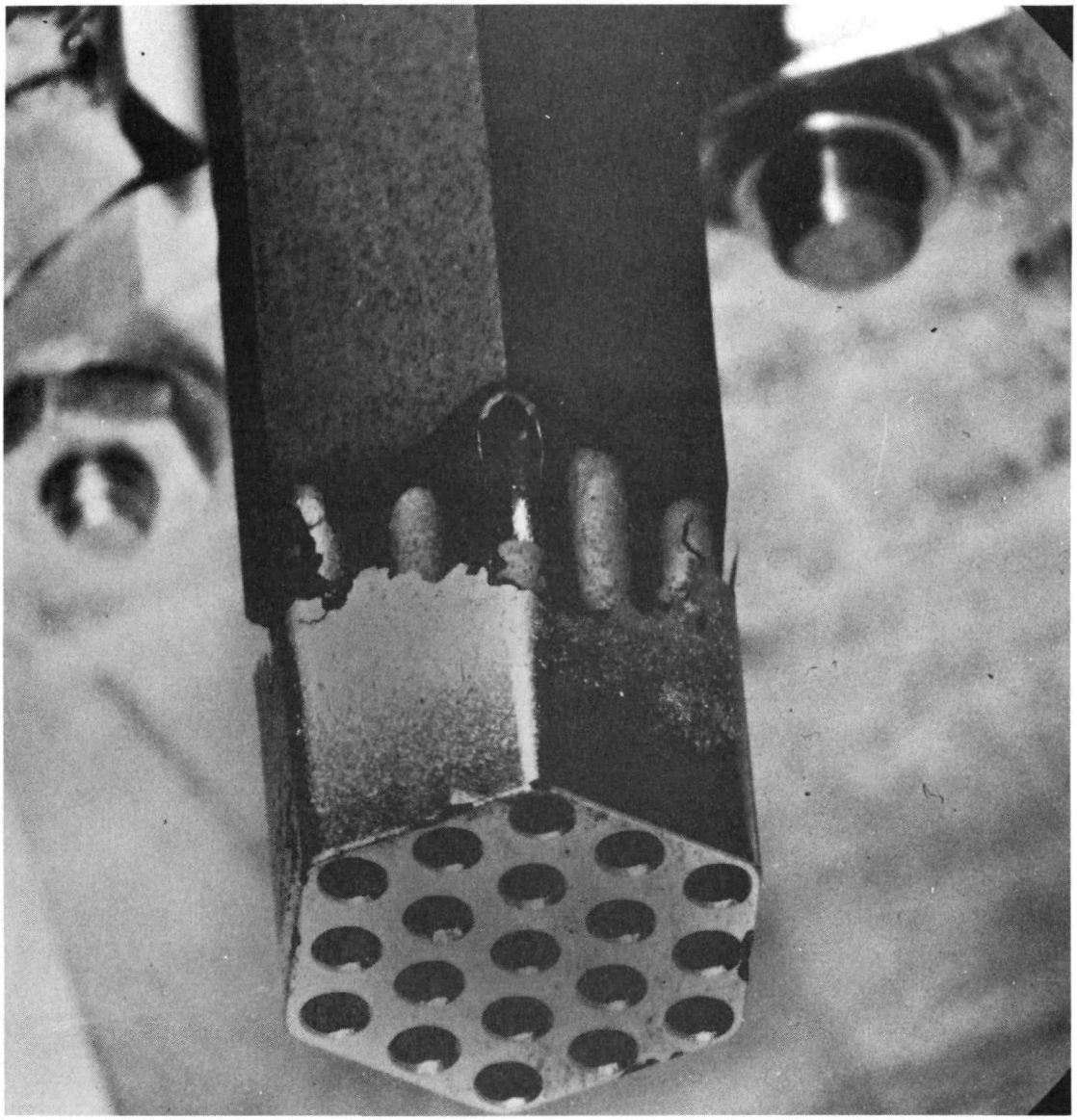
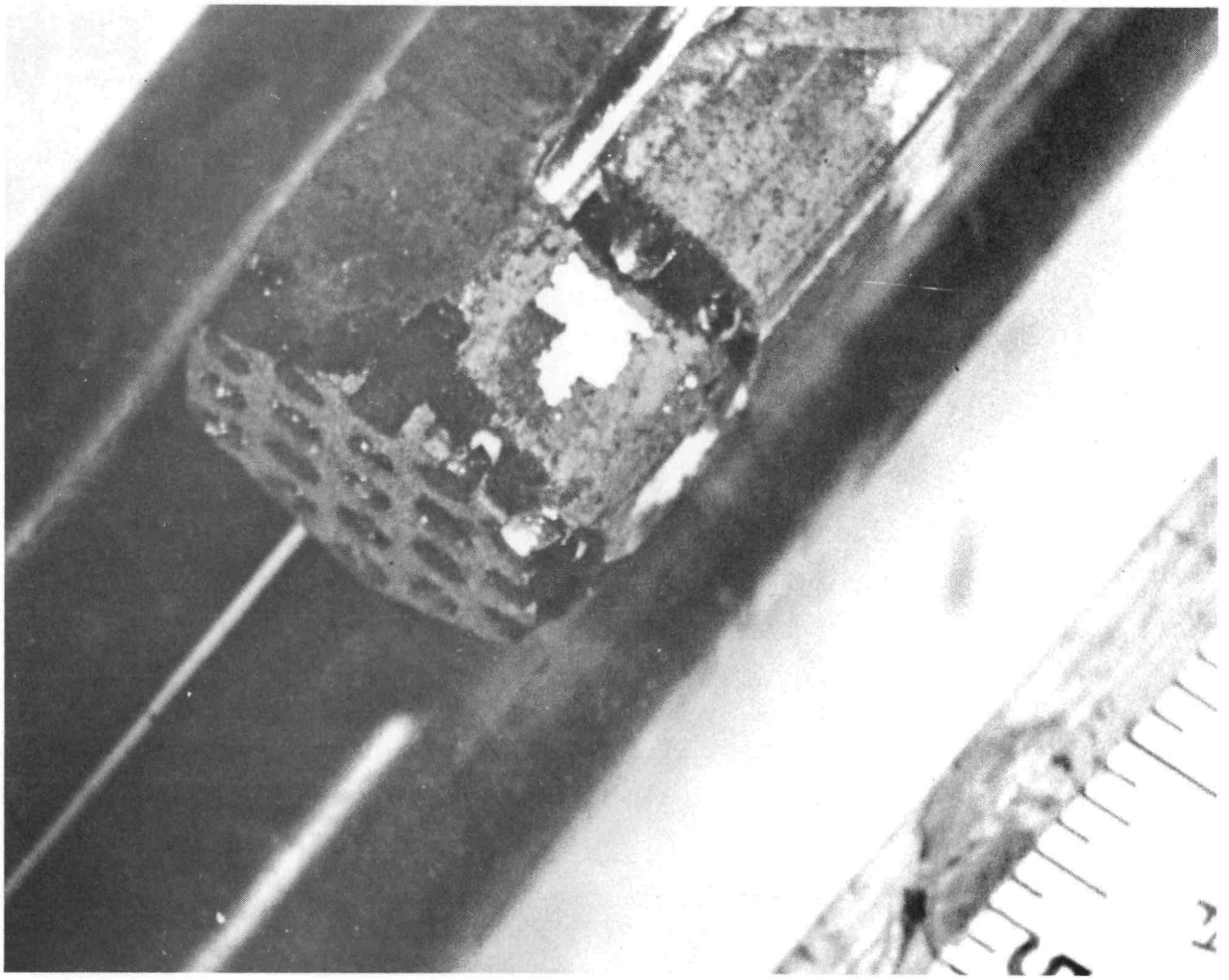
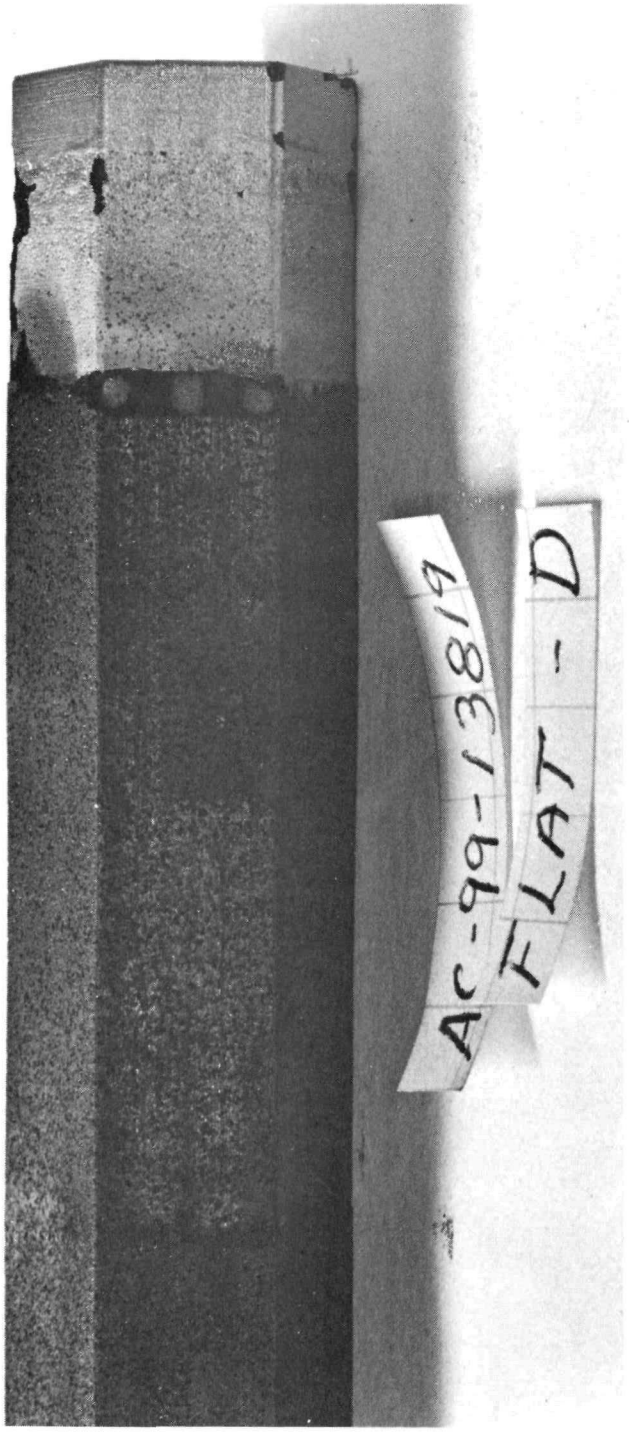
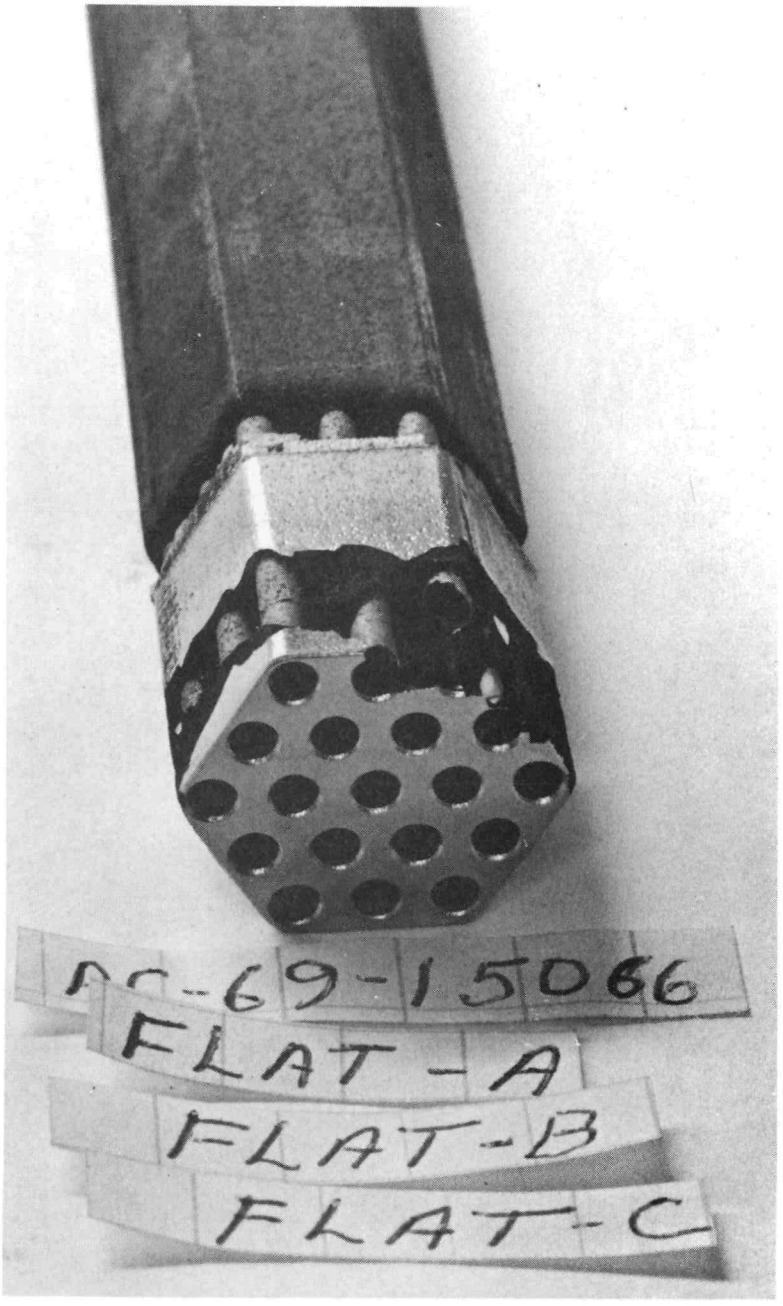
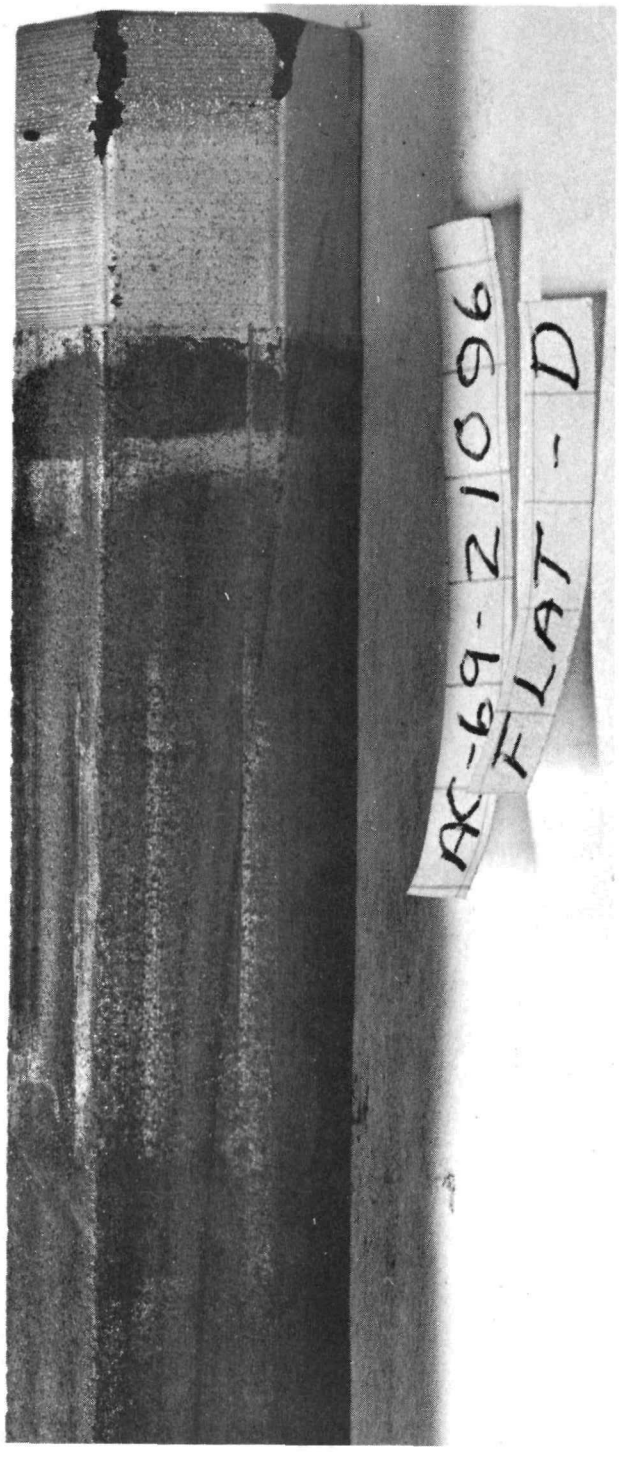


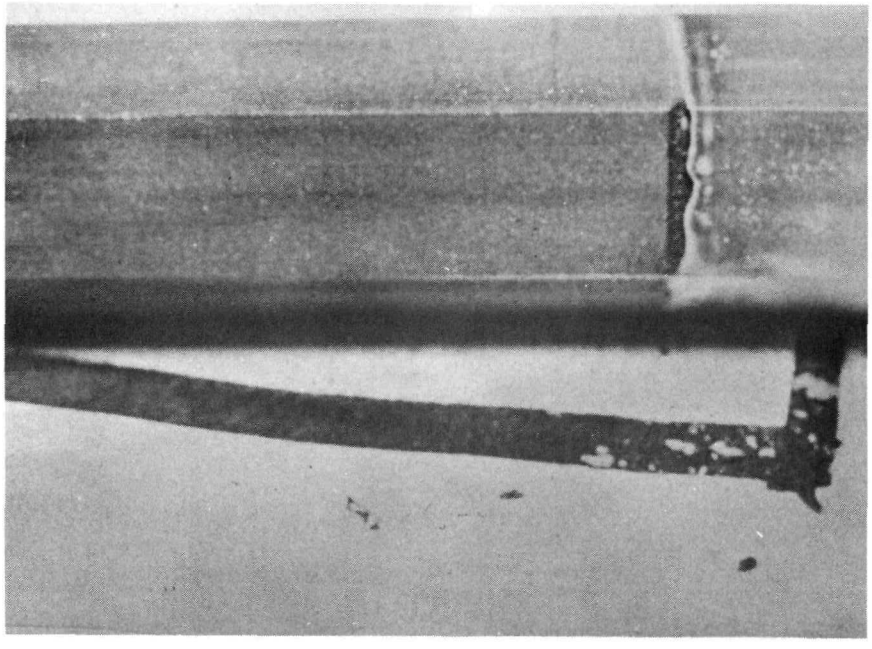


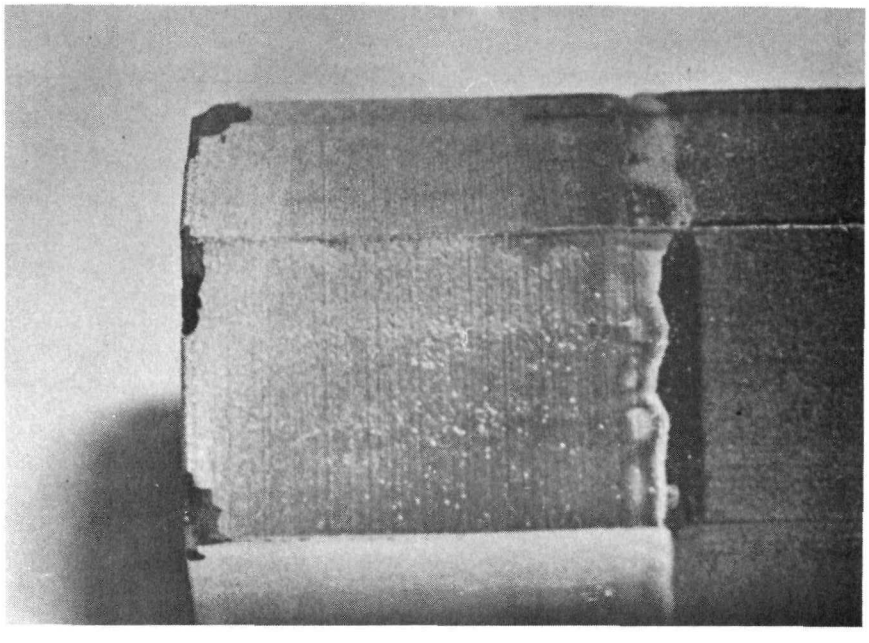



AC-69-15066
FLAT-A
FLAT-B
FLAT-C

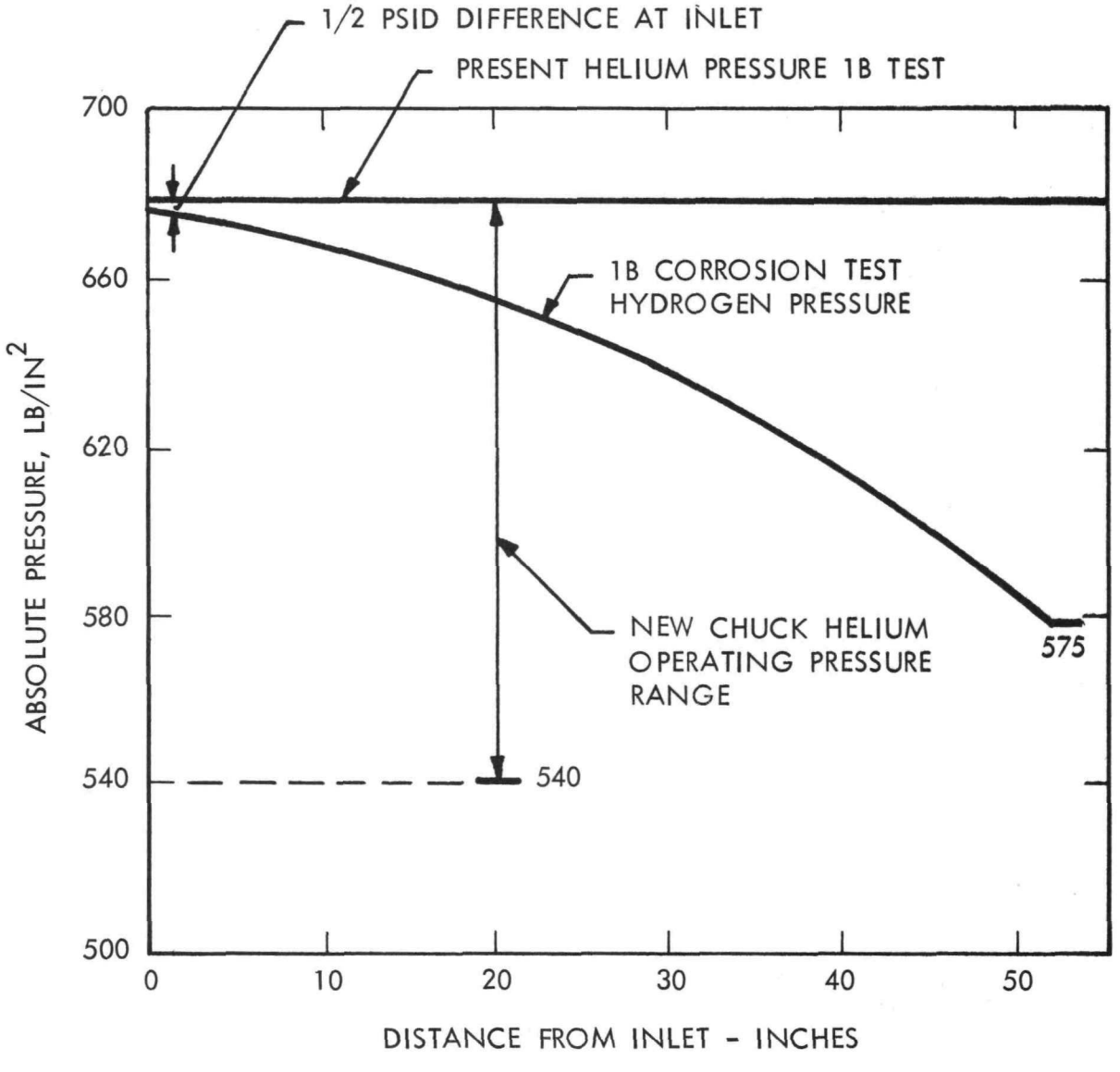

AX-69-21096
FLAT - D


AC-69-21098
FLAT - D

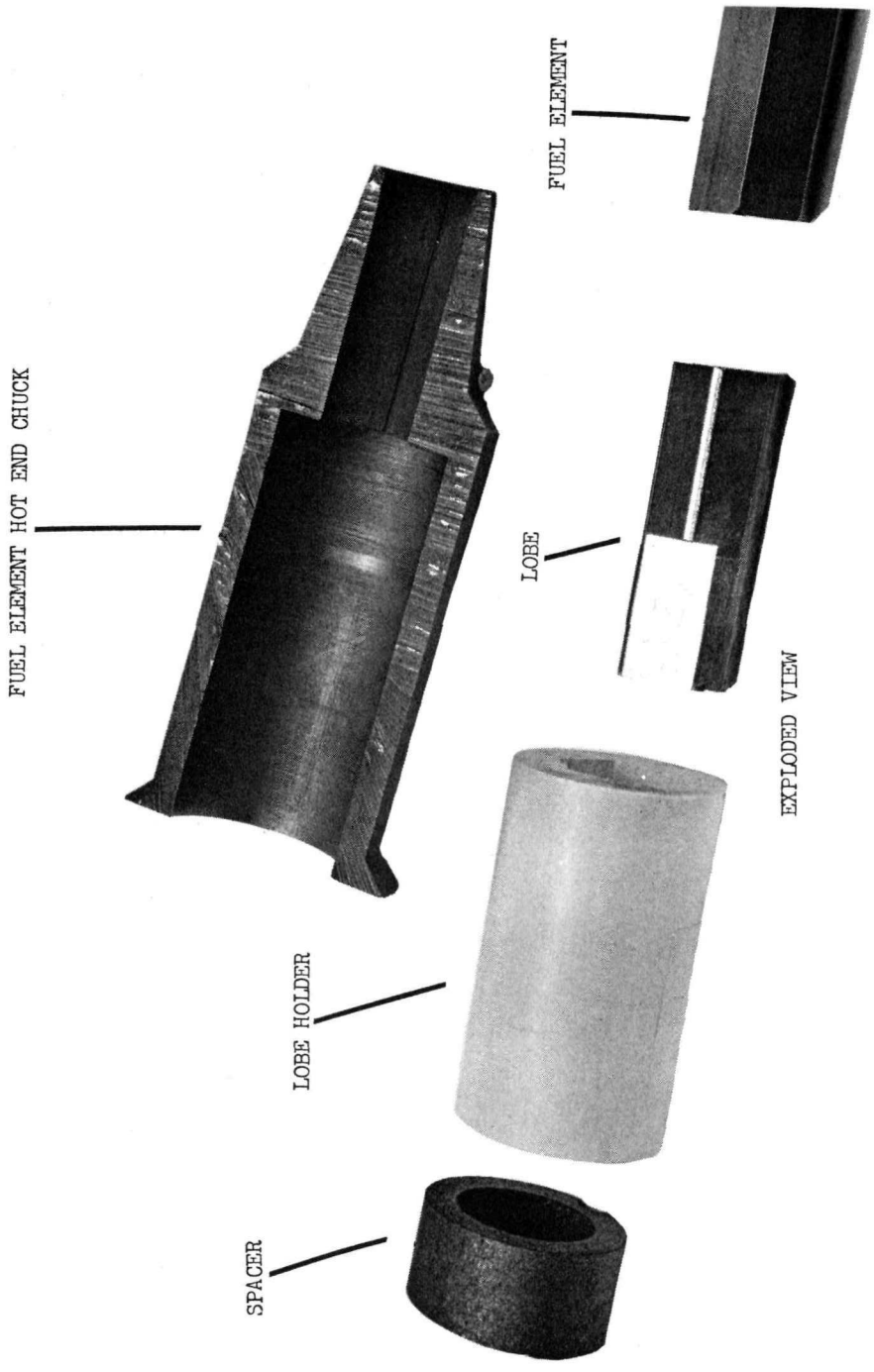


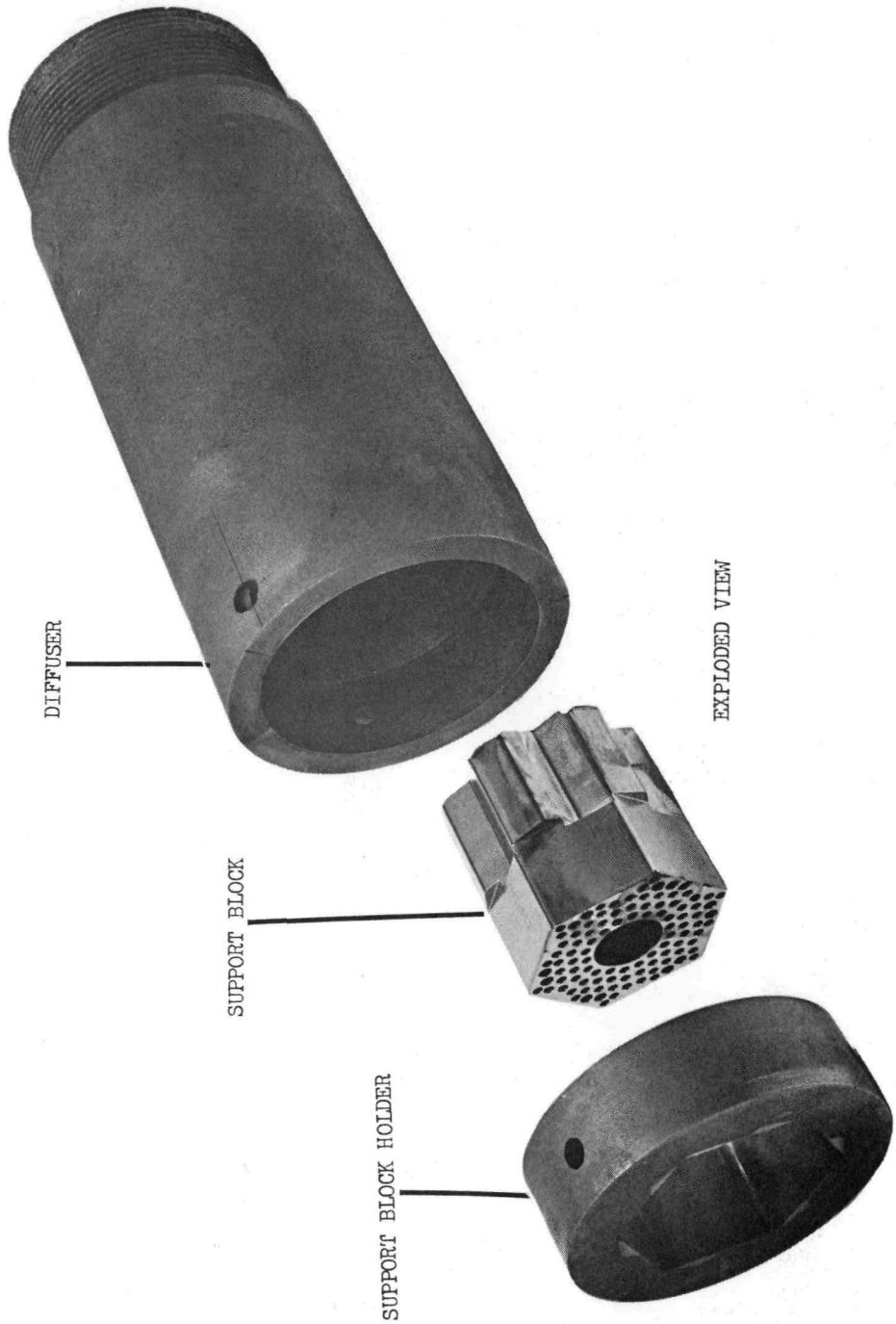


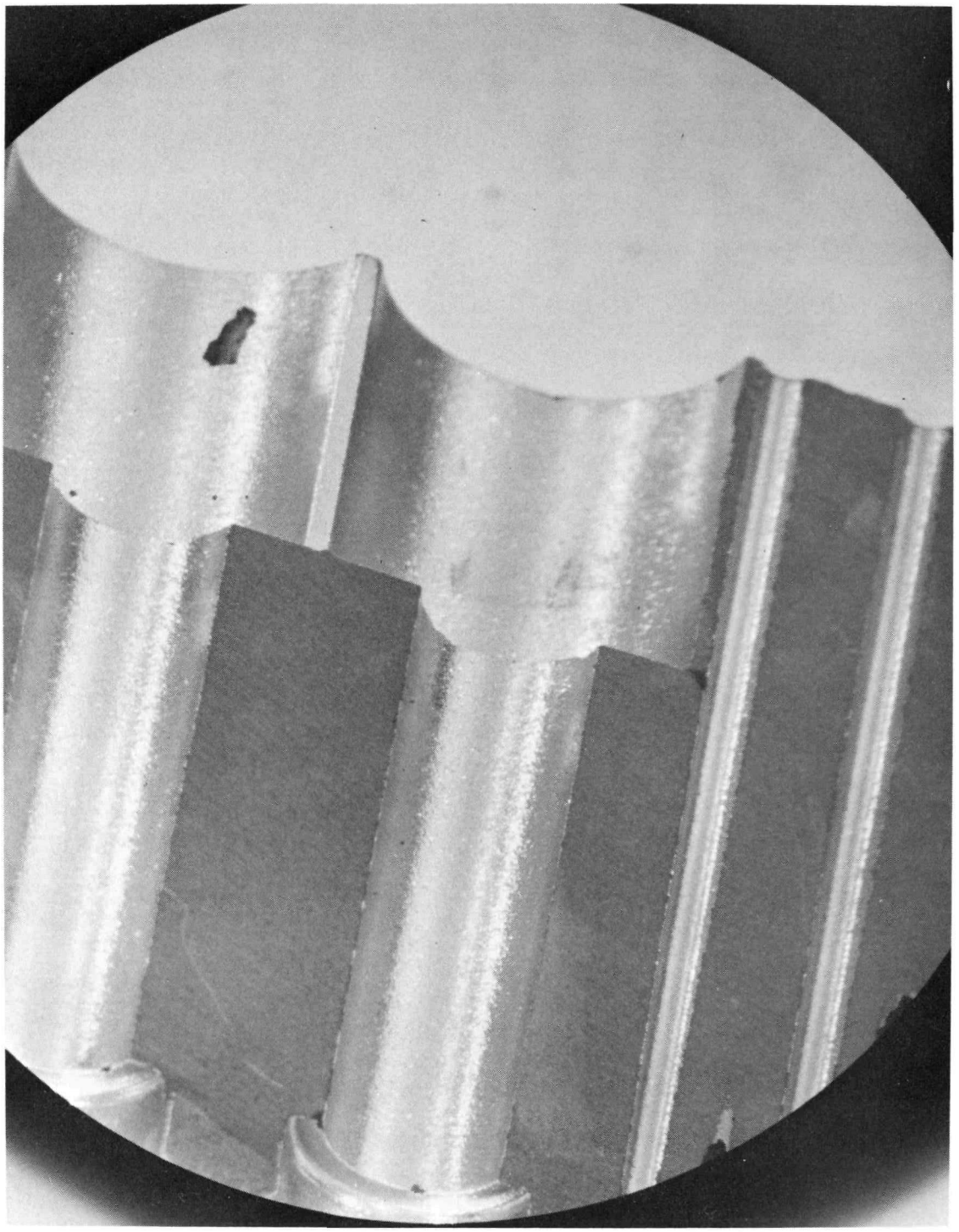
TYPICAL CORROSION BEHAVIOR OF FUEL ELEMENT IN CLUSTER TESTS

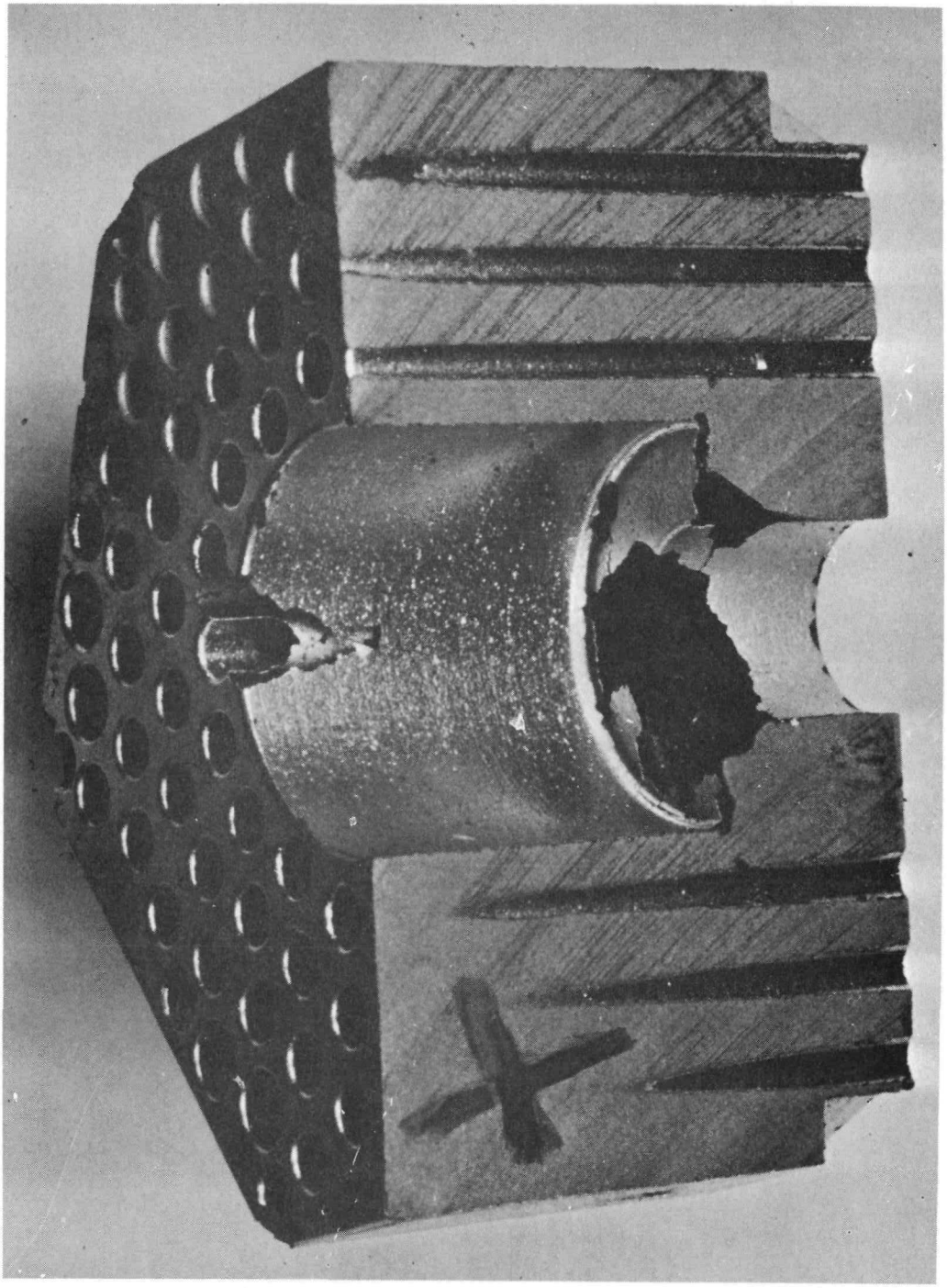


PRESSURE DISTRIBUTION - 1B HYDROGEN CORROSION TEST




EXPLODED VIEW
DIFFUSER
SUPPORT BLOCK
SUPPORT BLOCK HOLDER



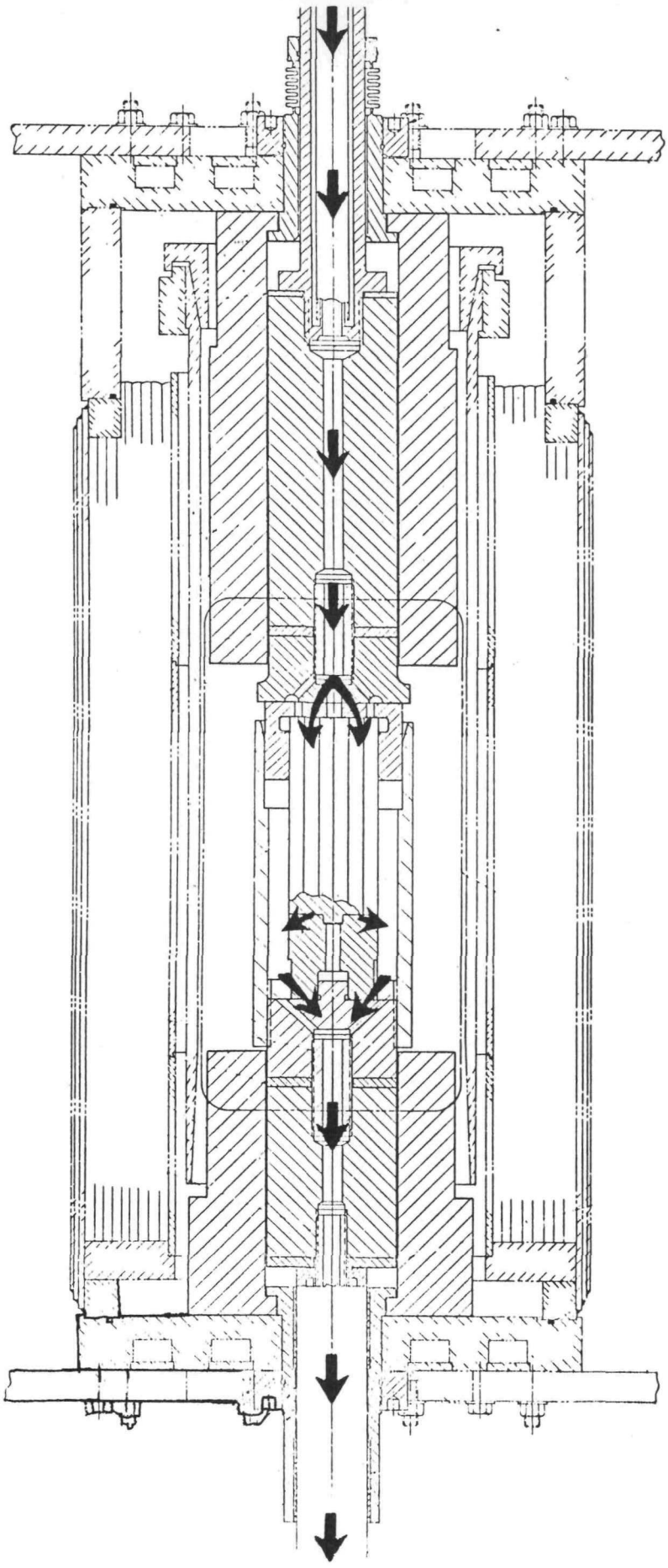


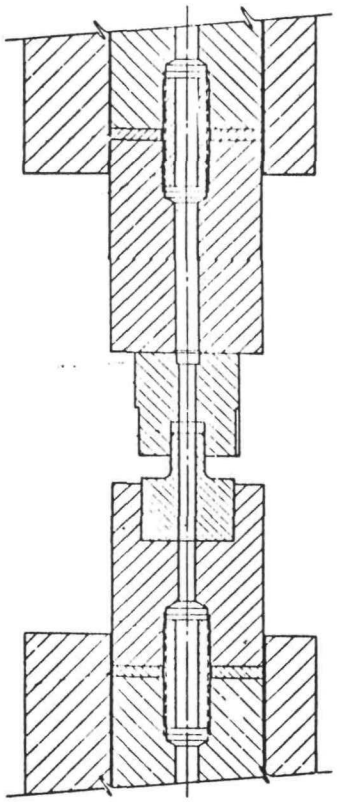
SUPPORT BLOCK SERIAL NO. A-21952
CRACK LOADED AND CORROSION TESTED
MAGNIFIED 1.5X

THE 10 INCH FURNACE IN OPERATION

FURNACE OPENED FOR SPECIMEN REMOVAL

603807C





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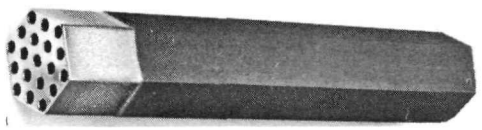
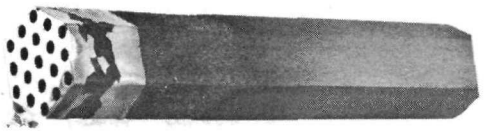
FUELED ELEMENTS TESTED 40 MINUTES IN 5 SCFM HYDROGEN

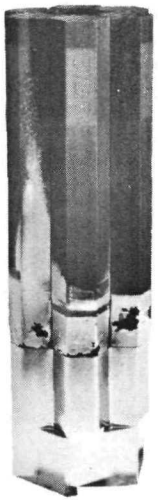
NRX–A3
ELEMENTS

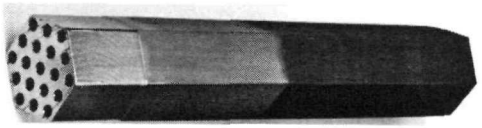


BEFORE TEST



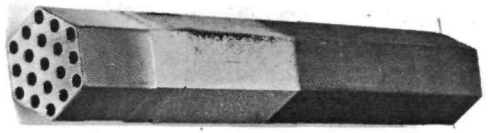
AFTER TEST





BEFORE TEST

NRX–A4
BACKCOATED
ELEMENTS



AFTER TEST

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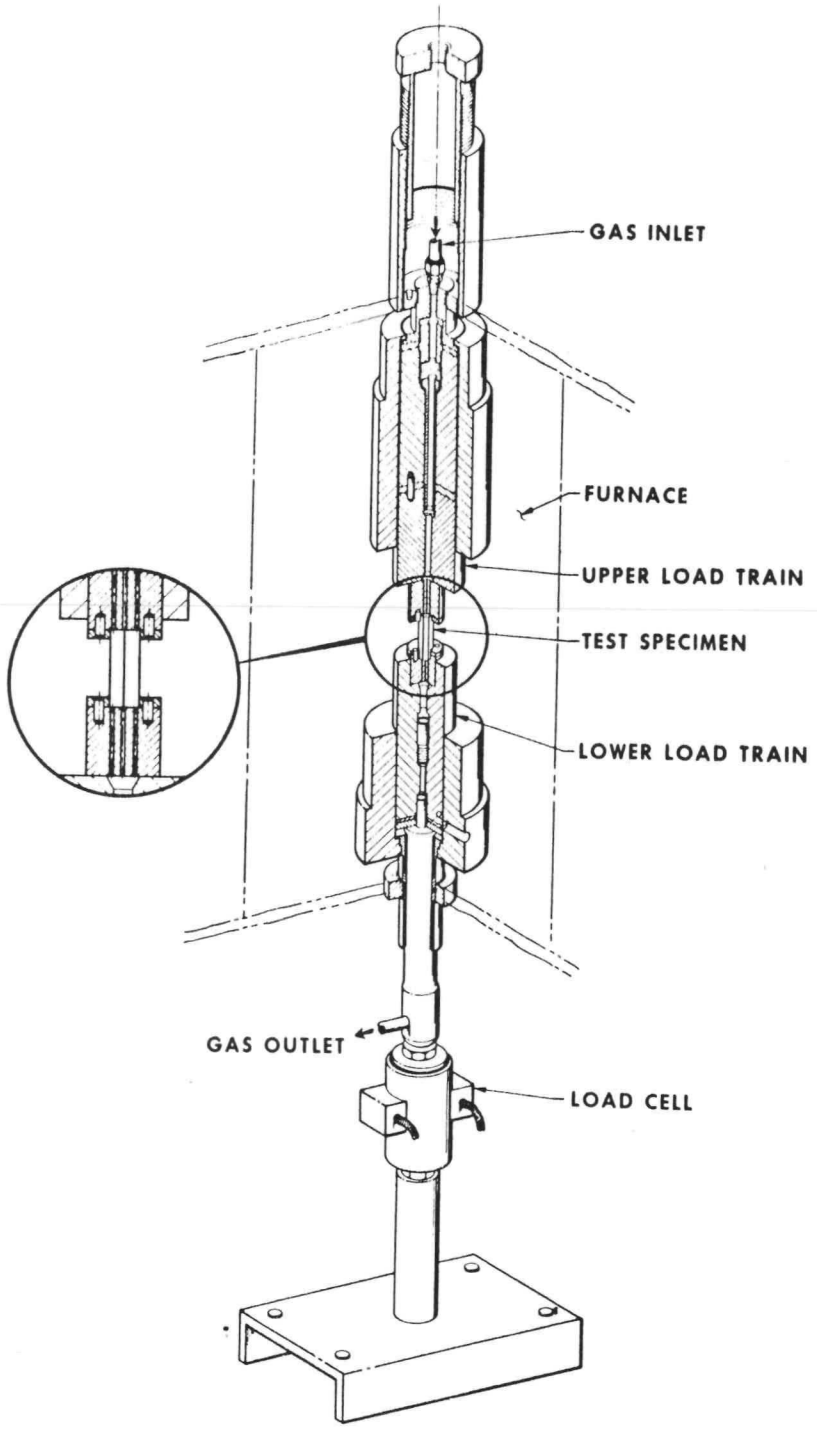
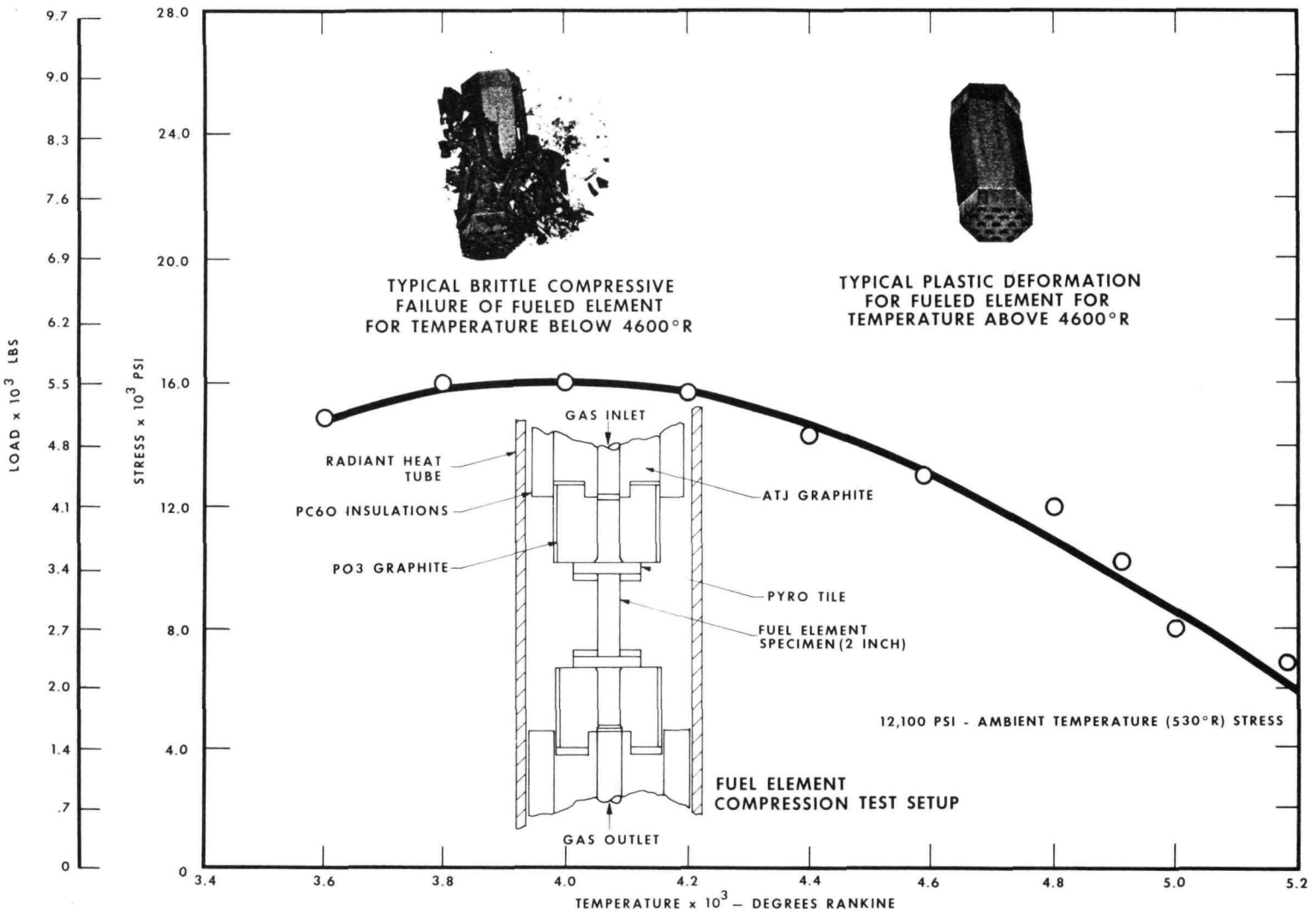


**FUEL ELEMENT HIGH TEMPERATURE
COMPRESSION TEST LOADING SYSTEM**



FUEL ELEMENT ULTIMATE STRENGTH AS A FUNCTION OF TEMPERATURE

FUEL ELEMENT TEST RESULTS

603492D

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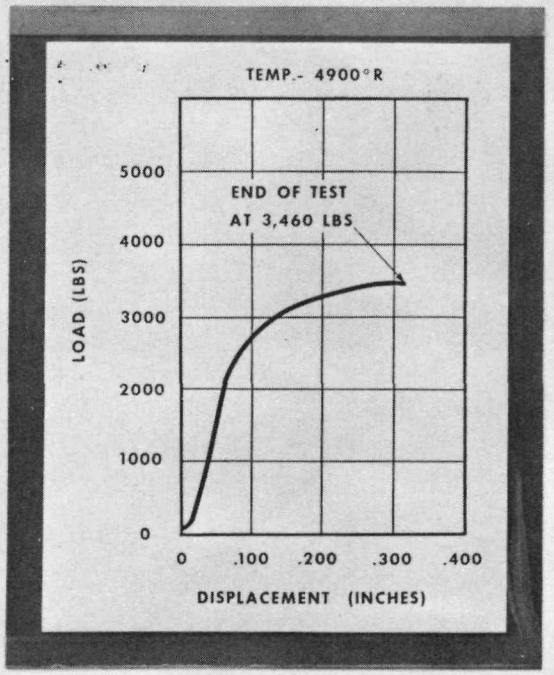
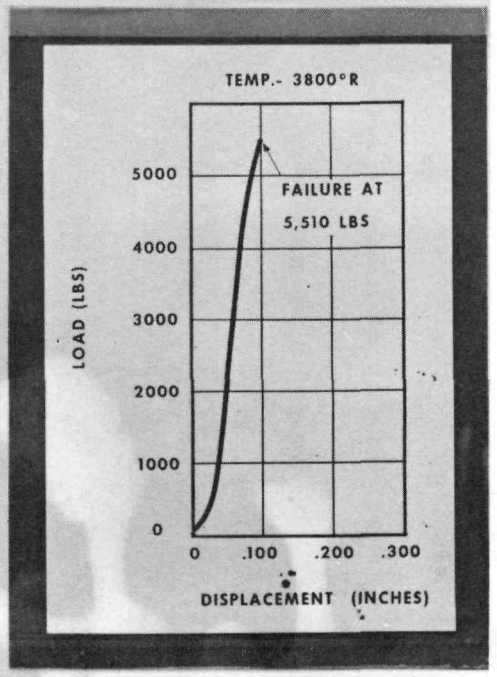
ENRICHED



TYPICAL PLASTIC DEFORMATION FAILURE



TYPICAL BRITTLE FAILURE

FUEL ELEMENT COMPRESSION TEST RESULTS

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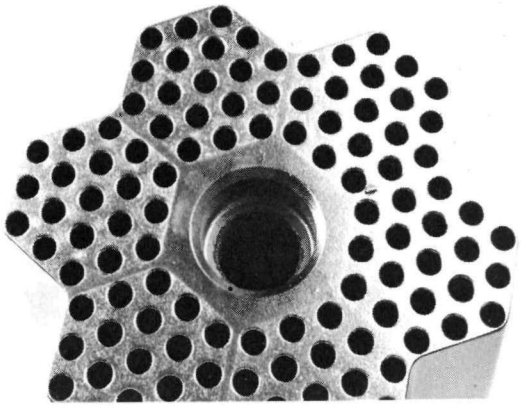
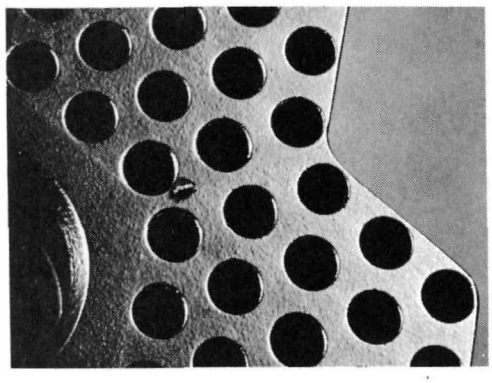
NbC WELDING TESTS



END VIEW OF SUPPORT BLOCK AFTER SEPARATION. THE FROSTED APPEARANCE INDICATES THE POINTS OF WELDING

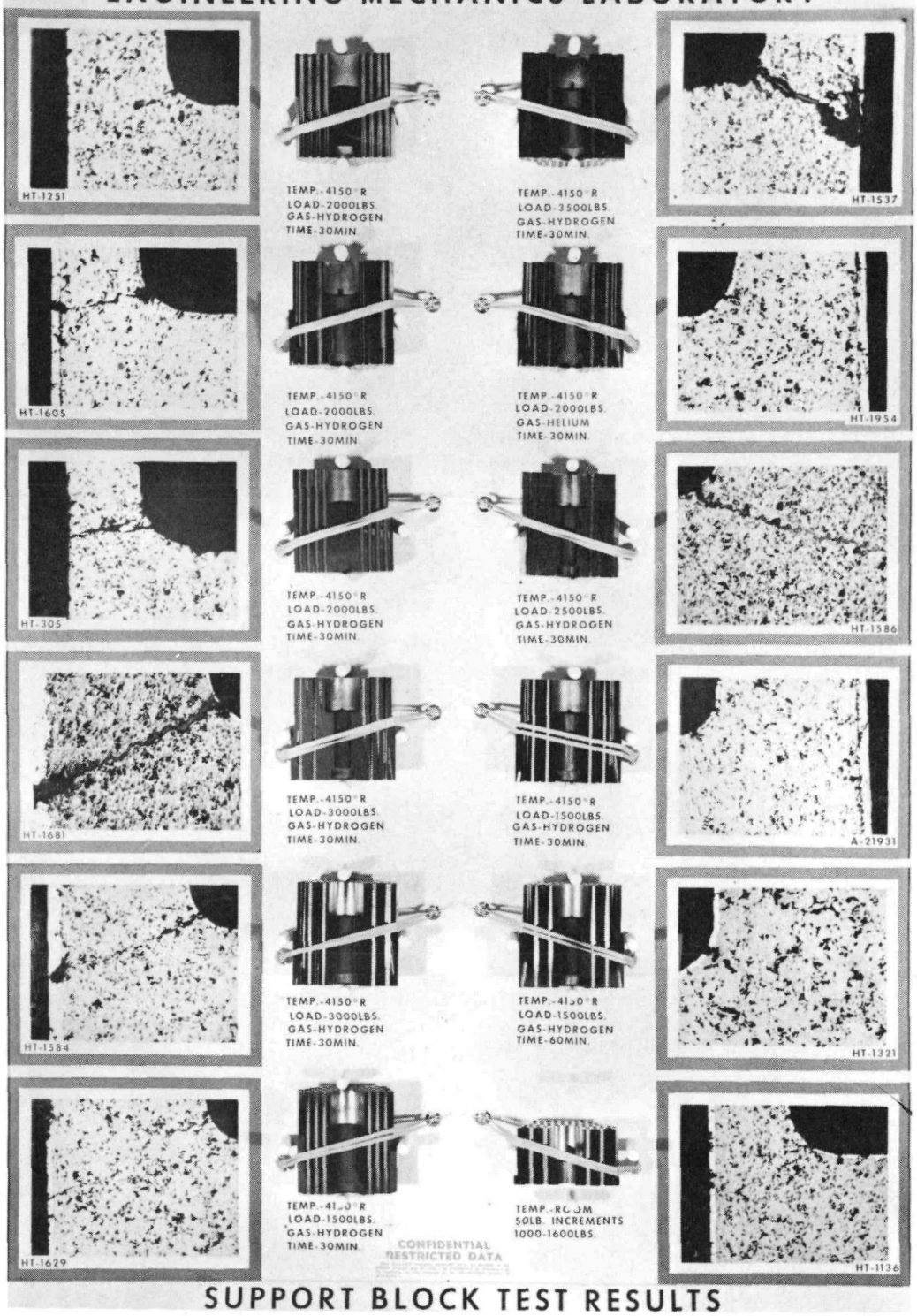


ENLARGED VIEW OF CHIP PULLED FROM ELEMENT ON SEPARATION.

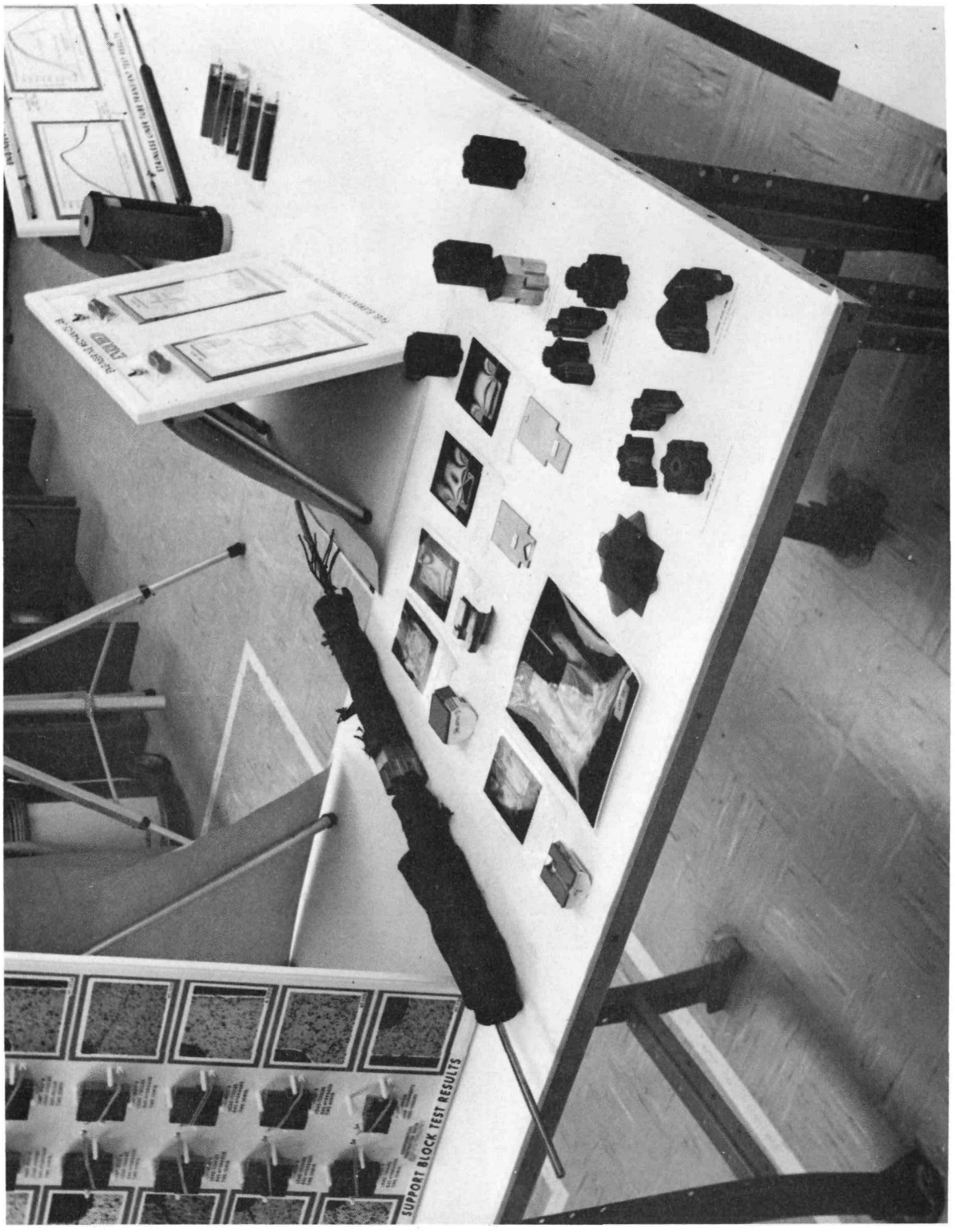
AN EXAMPLE OF COMPLETE WELDING OF NbC COATINGS

603478D

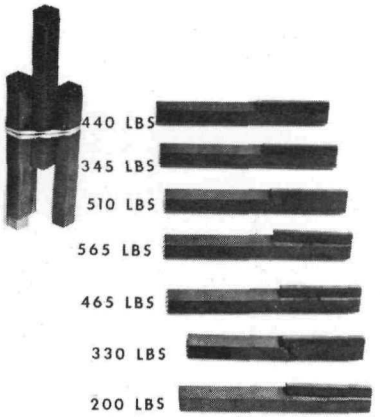
ENGINEERING MECHANICS LABORATORY



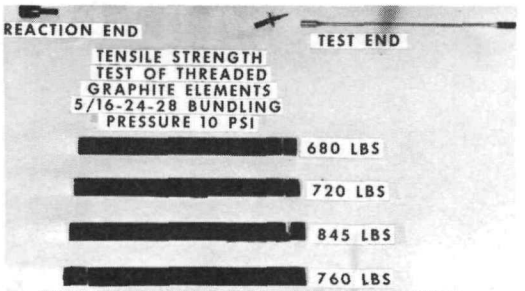
SUPPORT BLOCK TEST RESULTS


SUPPORT BLOCK TEST RESULTS

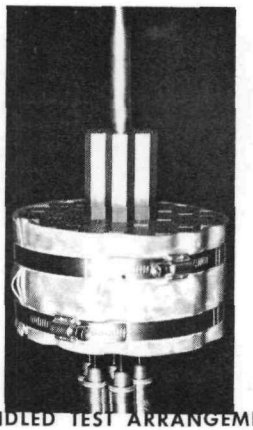
CLUSTER DEVELOPMENT TEST RESULTS



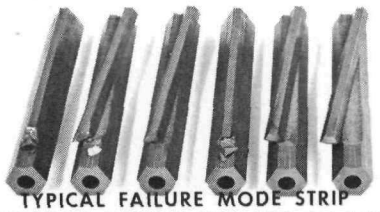
TYPICAL KEY FAILURE MODES



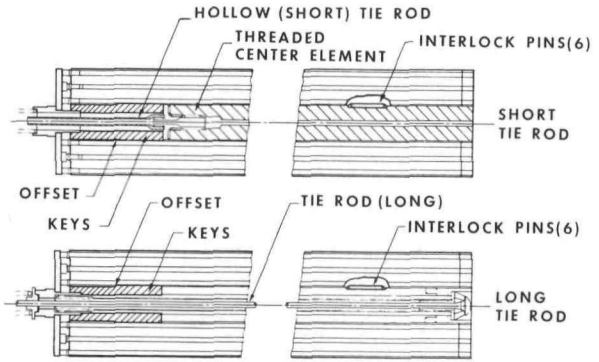
TYPICAL THREAD TEST FAILURE MODES



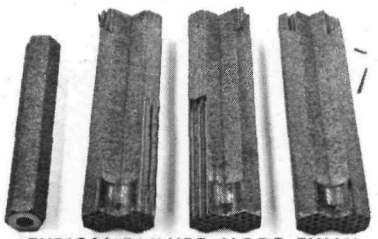
BUNDLED TEST ARRANGEMENT



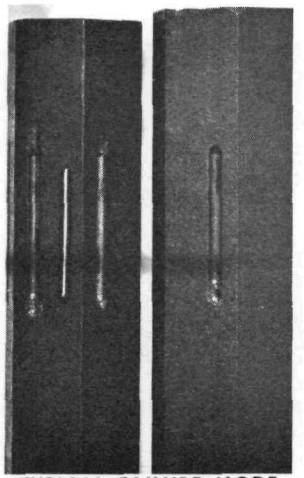
TYPICAL FAILURE MODE STRIP SUPPORTED DESIGN 4150 LBS AT 4500°R



DRAWING OF COLD-END SUPPORTED DESIGN



TYPICAL FAILURE MODE FULLY BONDED DESIGN 6550 LBS AT 4500°R



TYPICAL FAILURE MODE FOR HOT-END PIN DESIGN

603474D

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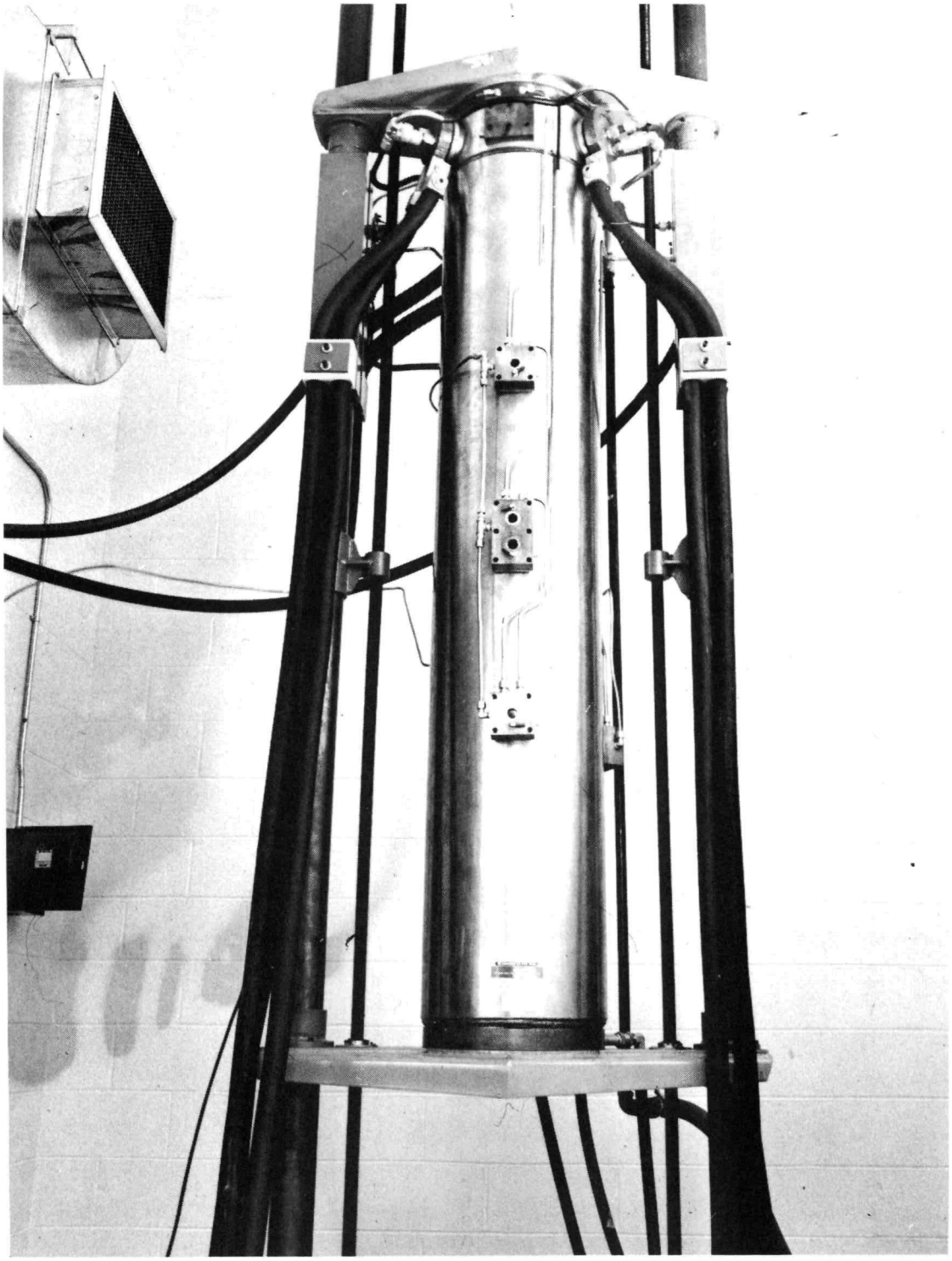
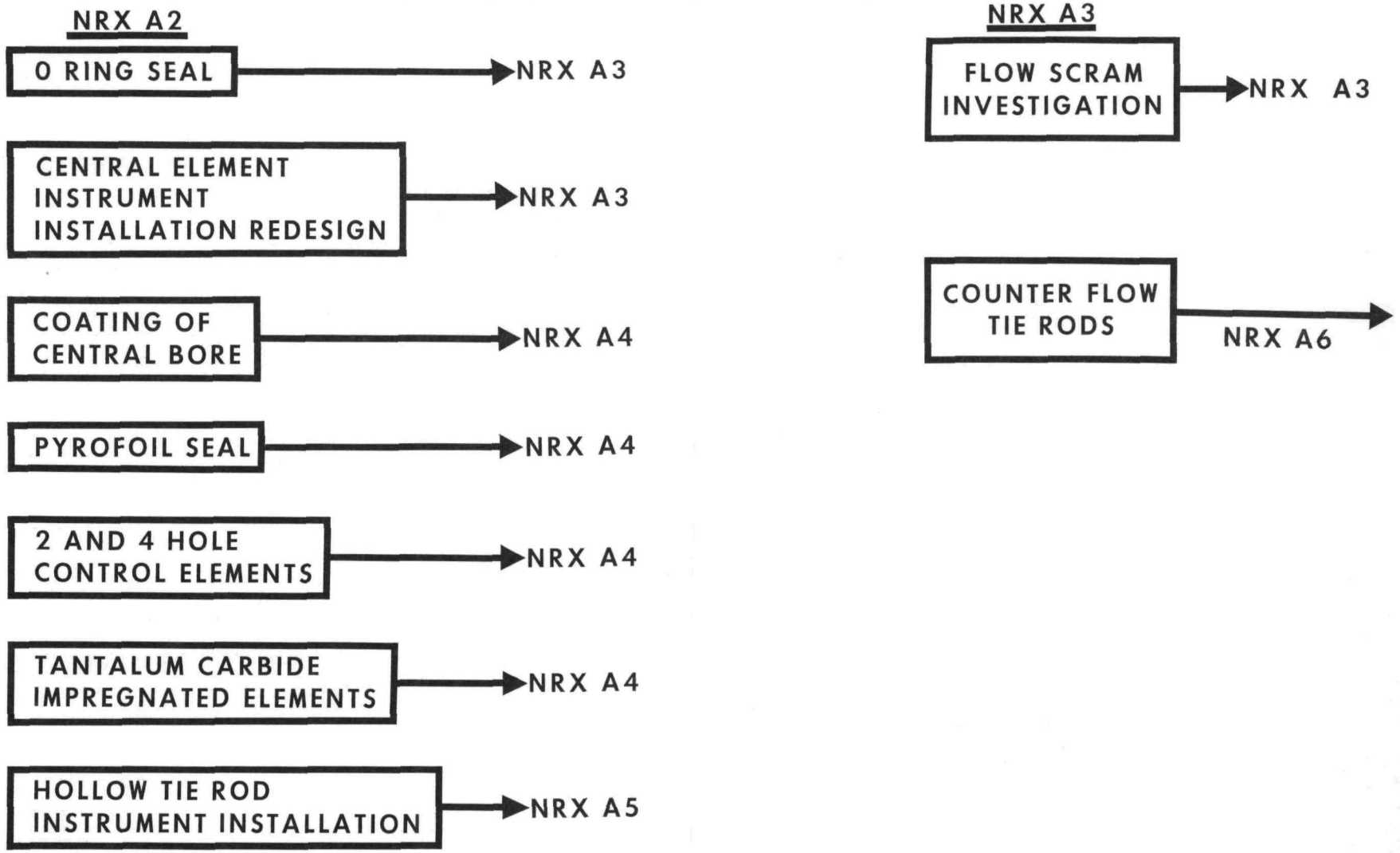
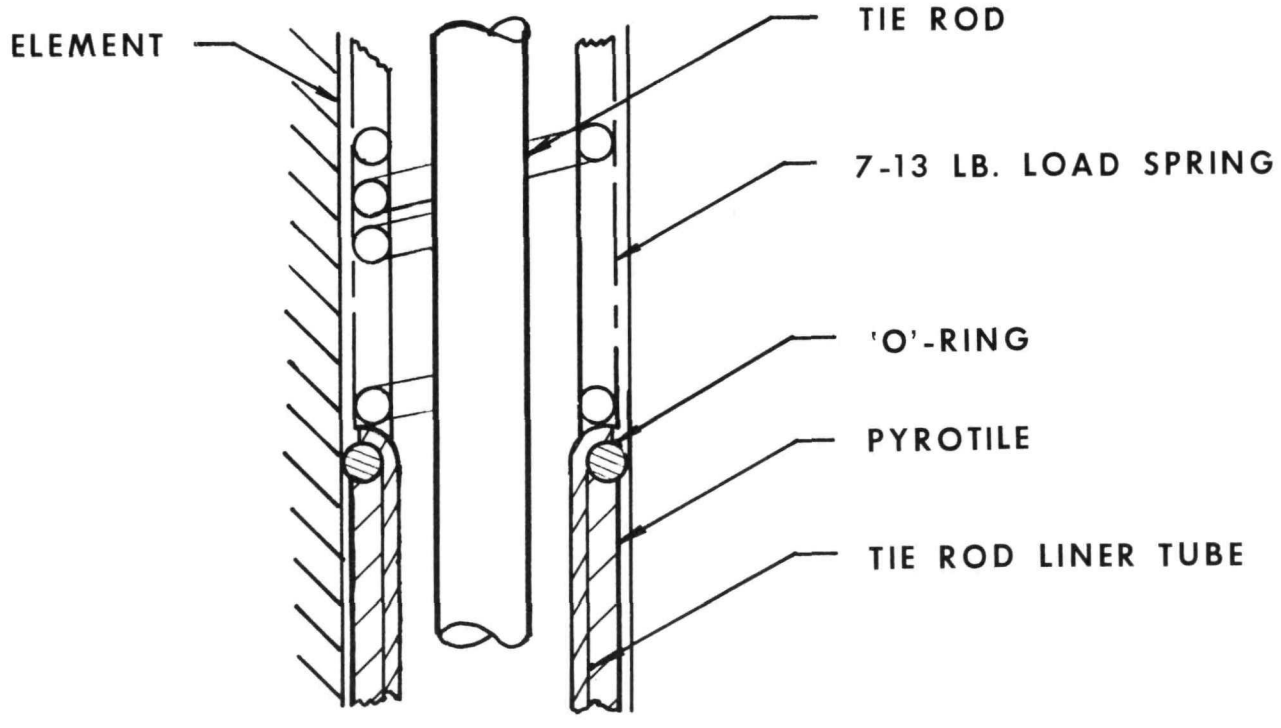


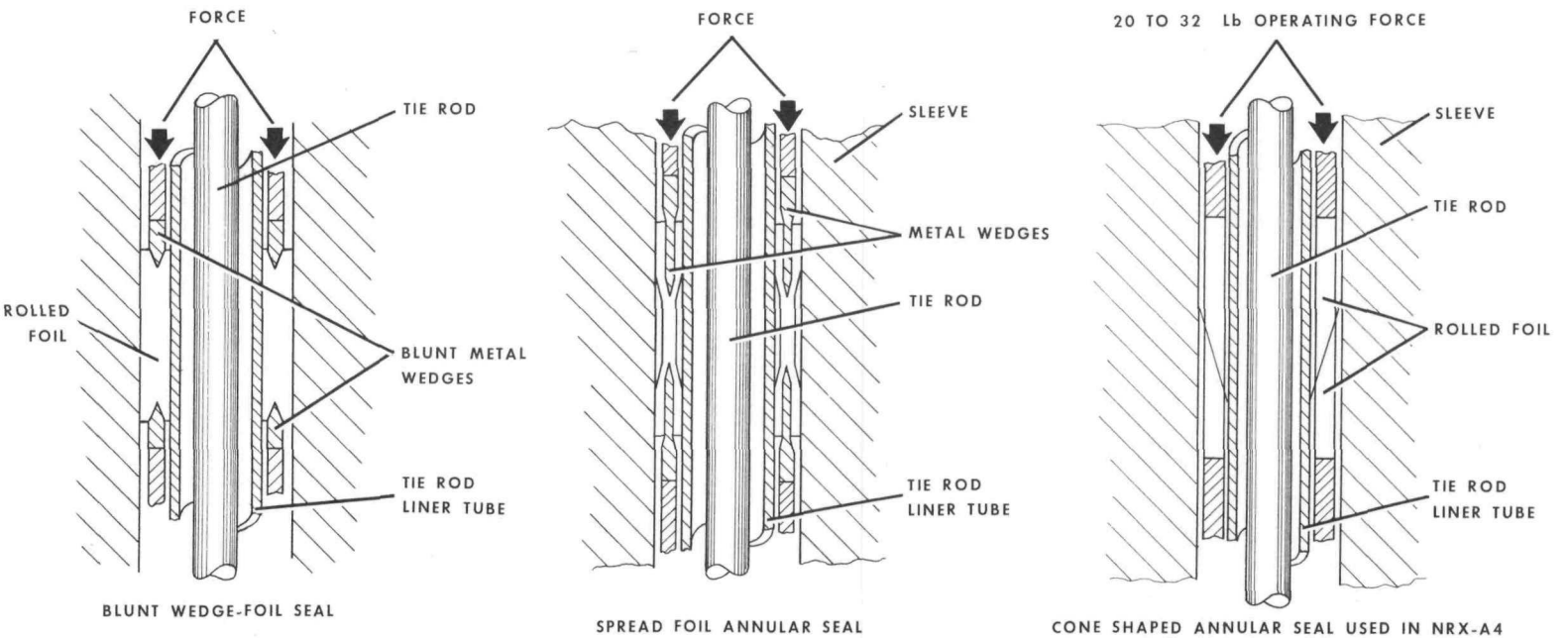
CENTRAL ELEMENT AND TIE ROD INTEGRITY





'O'-RING SEAL USED IN NRX-A3

603125B



EVOLUTION OF A CENTRAL ELEMENT LINER TUBE SEALING DEVICE

603127B

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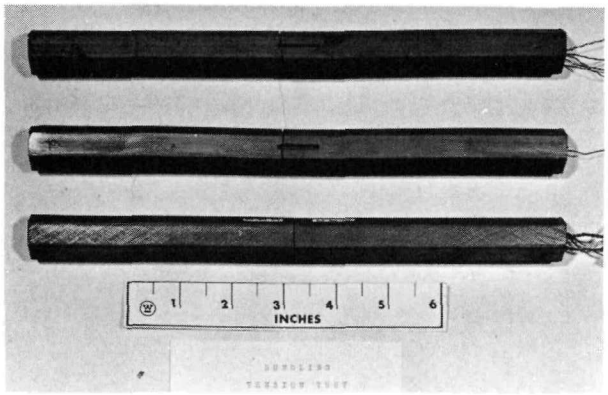
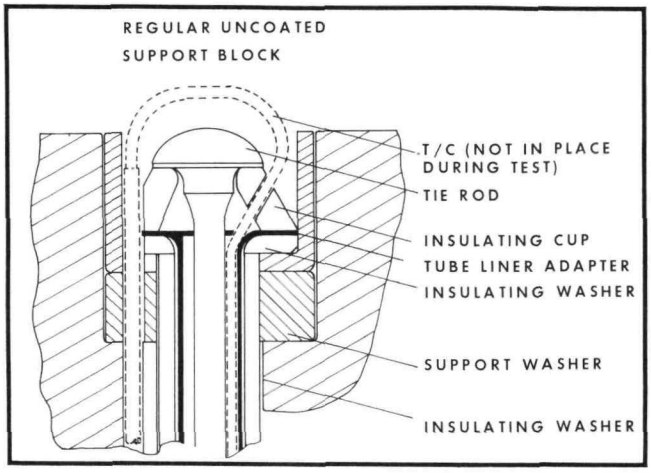
THERMOCOUPLE INSTRUMENTED COMPONENTS EFFECT ON STRENGTH

FUEL ELEMENTS WITH T/C SLOTS

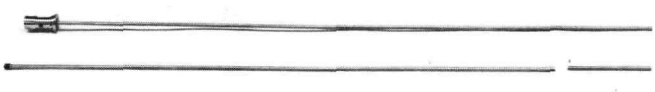


	PLAIN	SLOTTED	REDUCTION %
TENSILE, PSI	4600	3840	17
FLEXURE, PSI	4420	3330	25



	STANDARD	MODIFIED
ULTIMATE FRACTURE LBS	4330	4340

HOLLOW INSTRUMENT TIE RODS



	INCONEL 718	
	SOLID TIE ROD	HOLLOW
TENSILE STRENGTH PSI	214,000	229,000
YIELD STRENGTH PSI	173,000	200,000
ELONGATION-%	10.2	5.6
CYCLE LIFE AT 800± 200 LBS.	3×10^6	0.65×10^6

THESE RODS DISQUALIFIED FOR NRX-A4

603444 D

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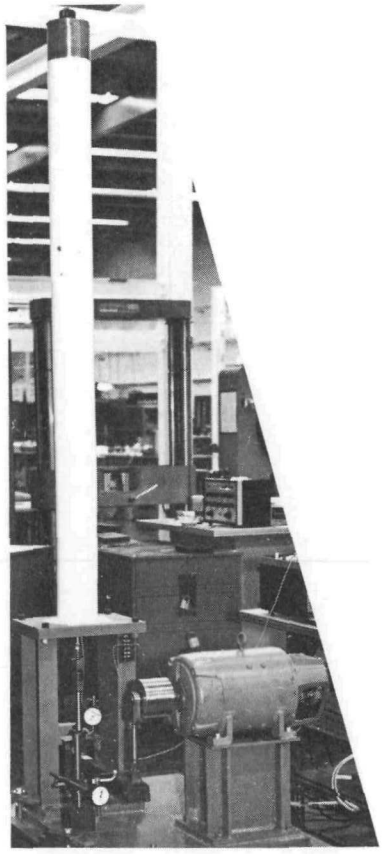
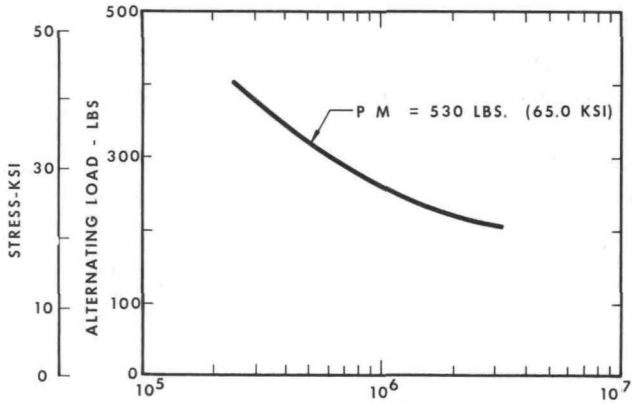
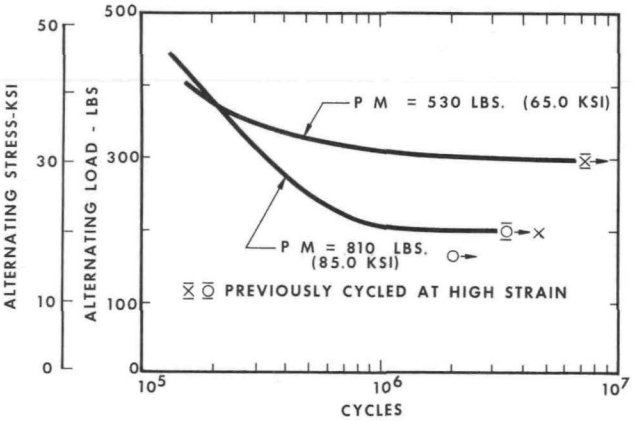
TIE ROD FATIGUE TESTS

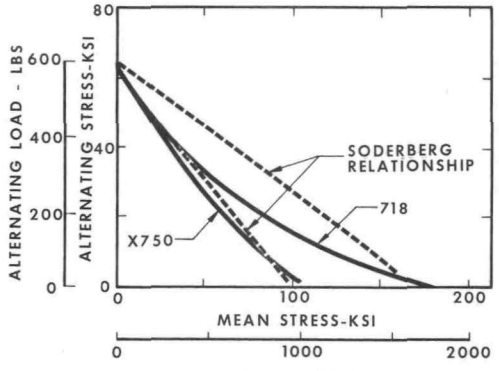




S-N CURVE FOR INCONEL X750 TIE RODS



S-N CURVES FOR INCONEL 718 TIE RODS

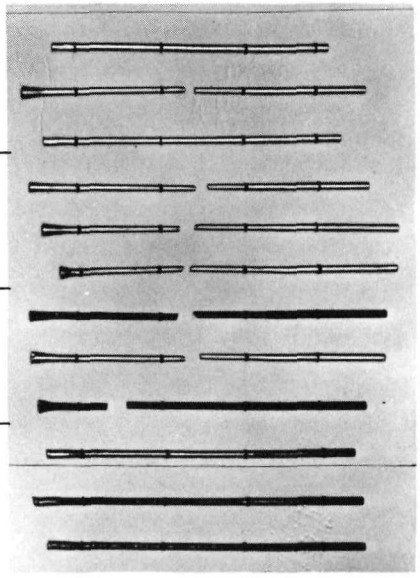


CONSTANT LIFE DIAGRAMS FOR NRX-A TIE RODS

SUMMARY OF TEST DATA		
TIE ROD ULTIMATE STRENGTHS-	X750	169,000psi (1600 lbs)
	718	214,000psi (2200 lbs)
TIE ROD DESIGN LOADS (STEADY)		530 TO 810 lbs
FATIGUE STRENGTH (2×10^6 CYCLES)	Pm=530lbs	x750 ±23,000psi (±220 lbs)
		718 ±31,600psi (±300 lbs)
	Pm=810lbs	x750 9,000psi (±85 lbs)
		718 21,000psi (±200 lbs)

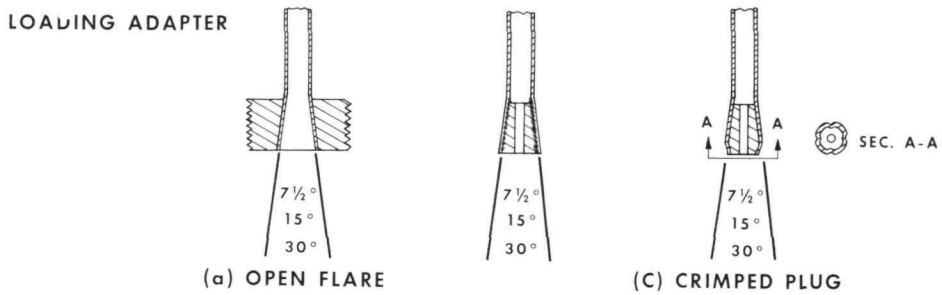
603438D

COUNTERFLOW TIE TUBE GEOMETRY DEVELOPMENT



OPEN FLARE	7½°	390 LBS.
	15°	655 LBS.
	30°	606 LBS.
BRAZED PLUG	7½°	685 LBS.
	15°	669 LBS.
	30°	637 LBS.
CRIMPED PLUG	7½°	582 LBS.
	15°	644 LBS.
	30°	567 LBS.
ANNEALED OPEN FLARE	15°	487 LBS.
	15°	567 LBS.
	15°	532 LBS.

TIE TUBE STRUCTURAL EVALUATION OF GEOMETRY EFFECT

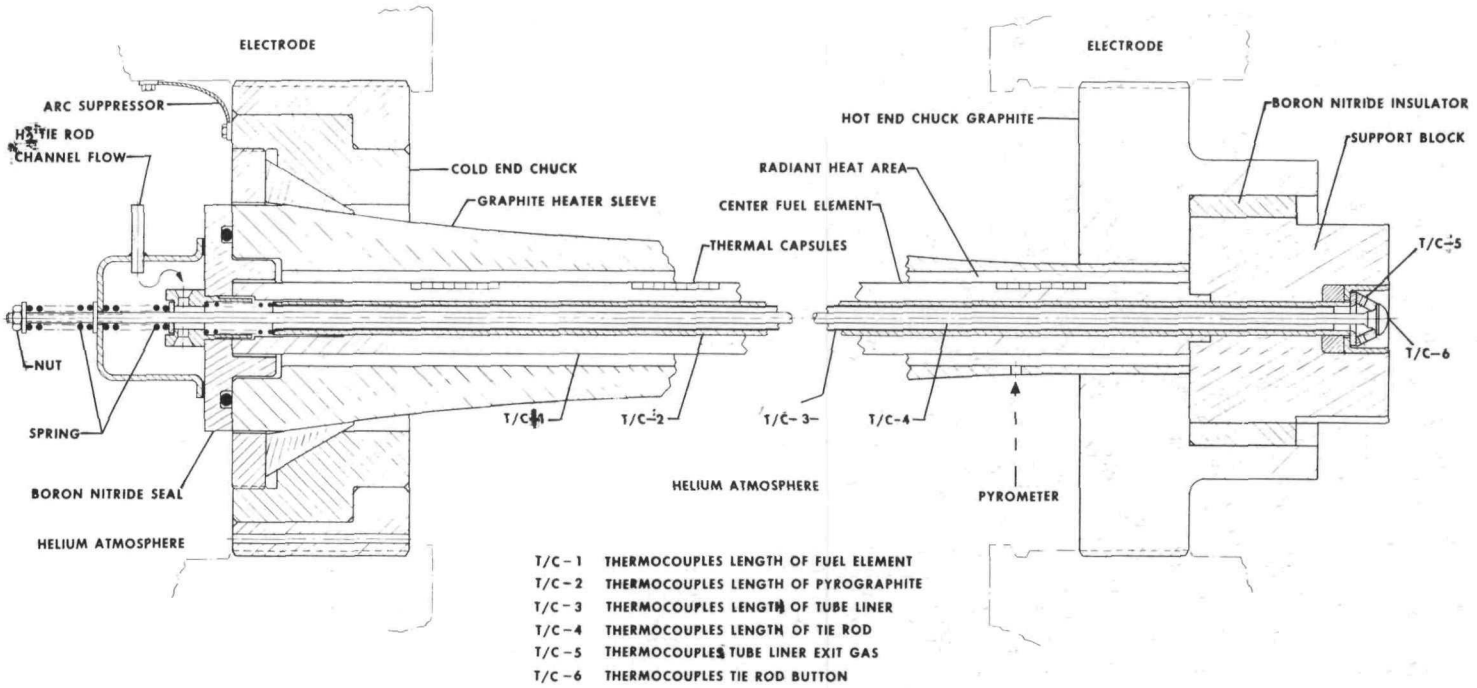


(a) OPEN FLARE

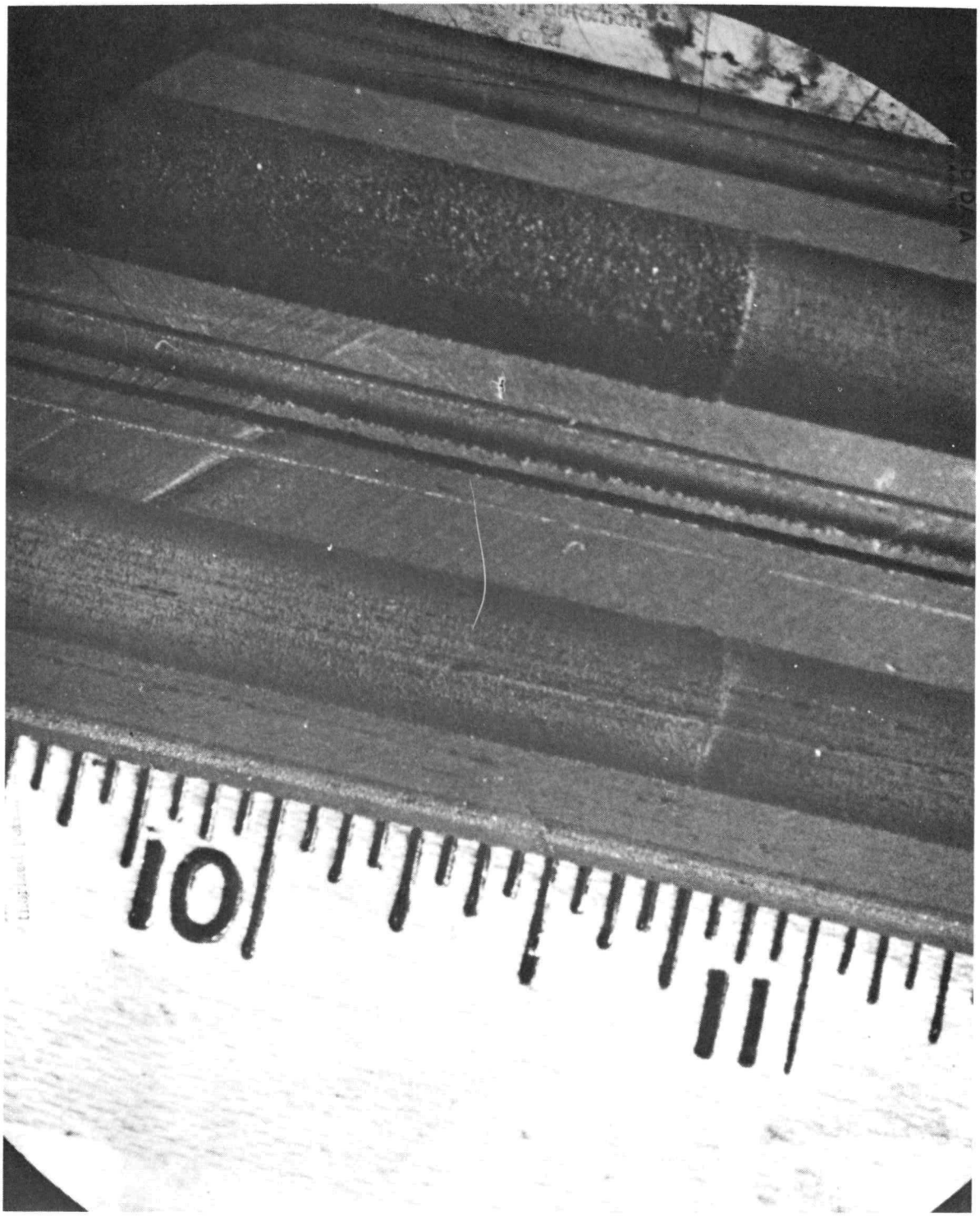
(b) BRAZED PLUG

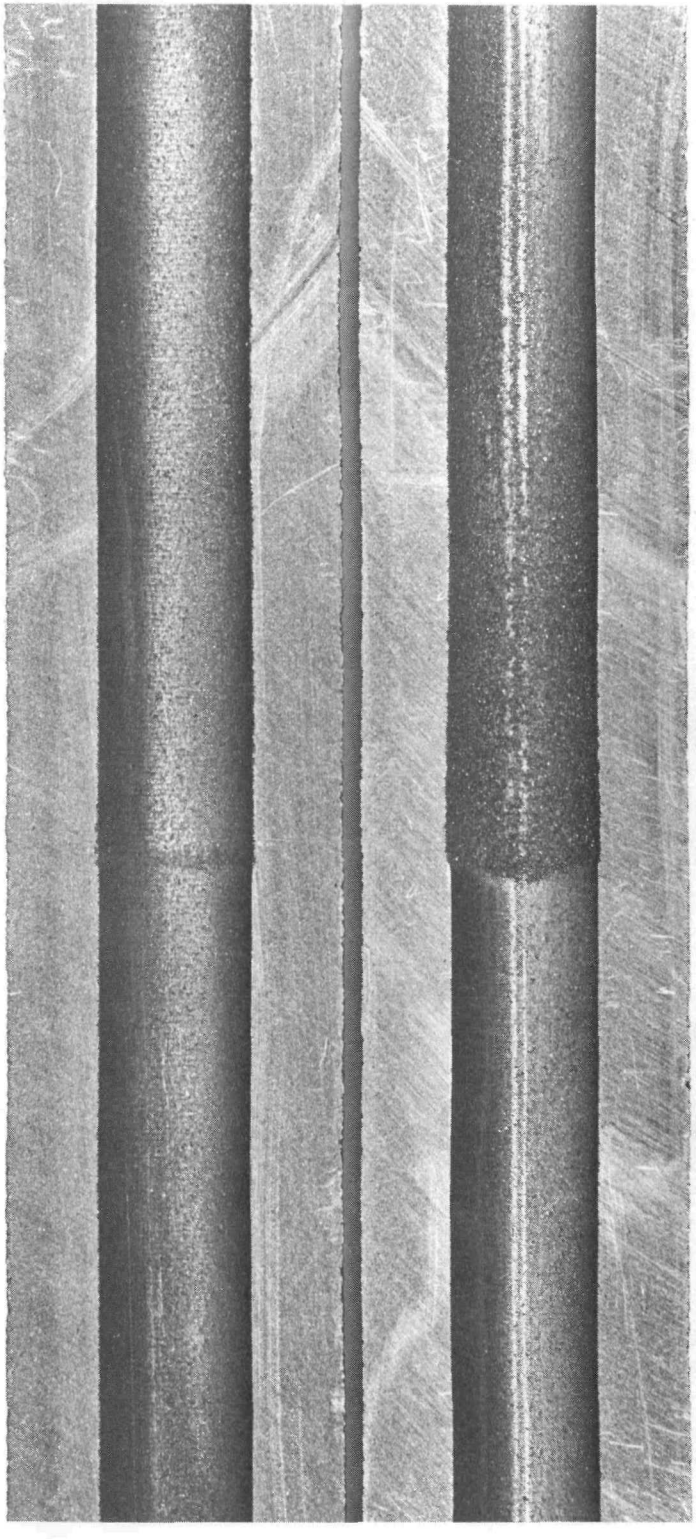
(C) CRIMPED PLUG

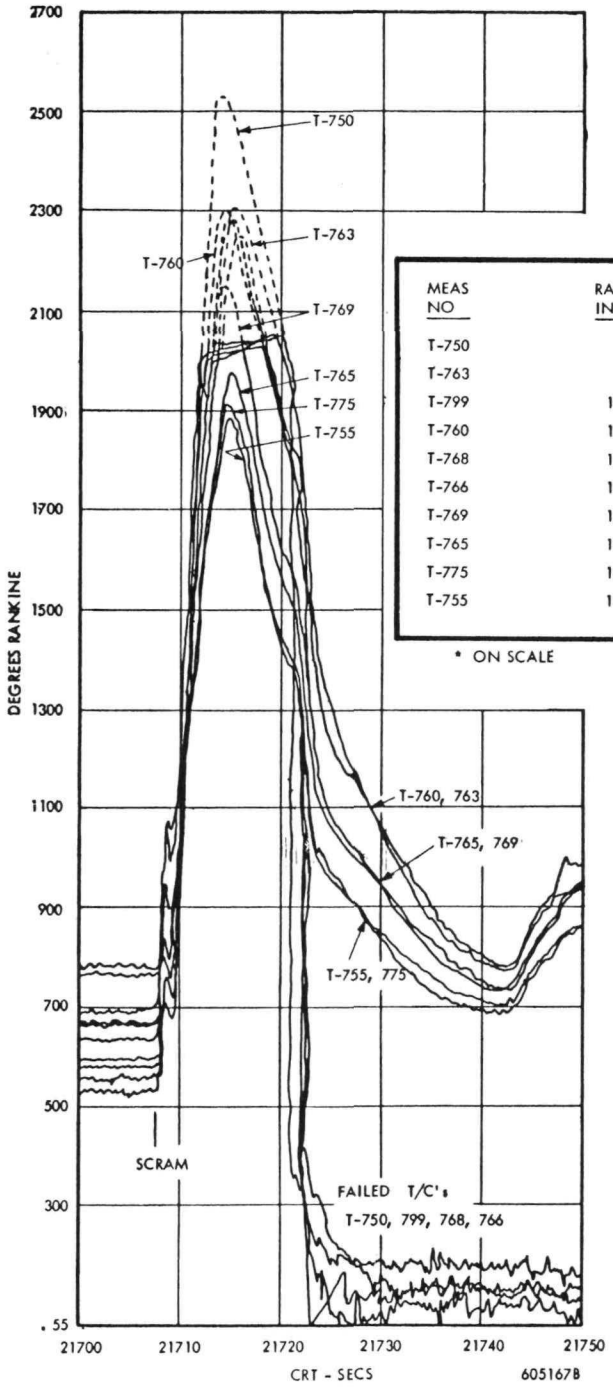
603439 D



RADIANT HEATING CENTER FUEL ELEMENT


10

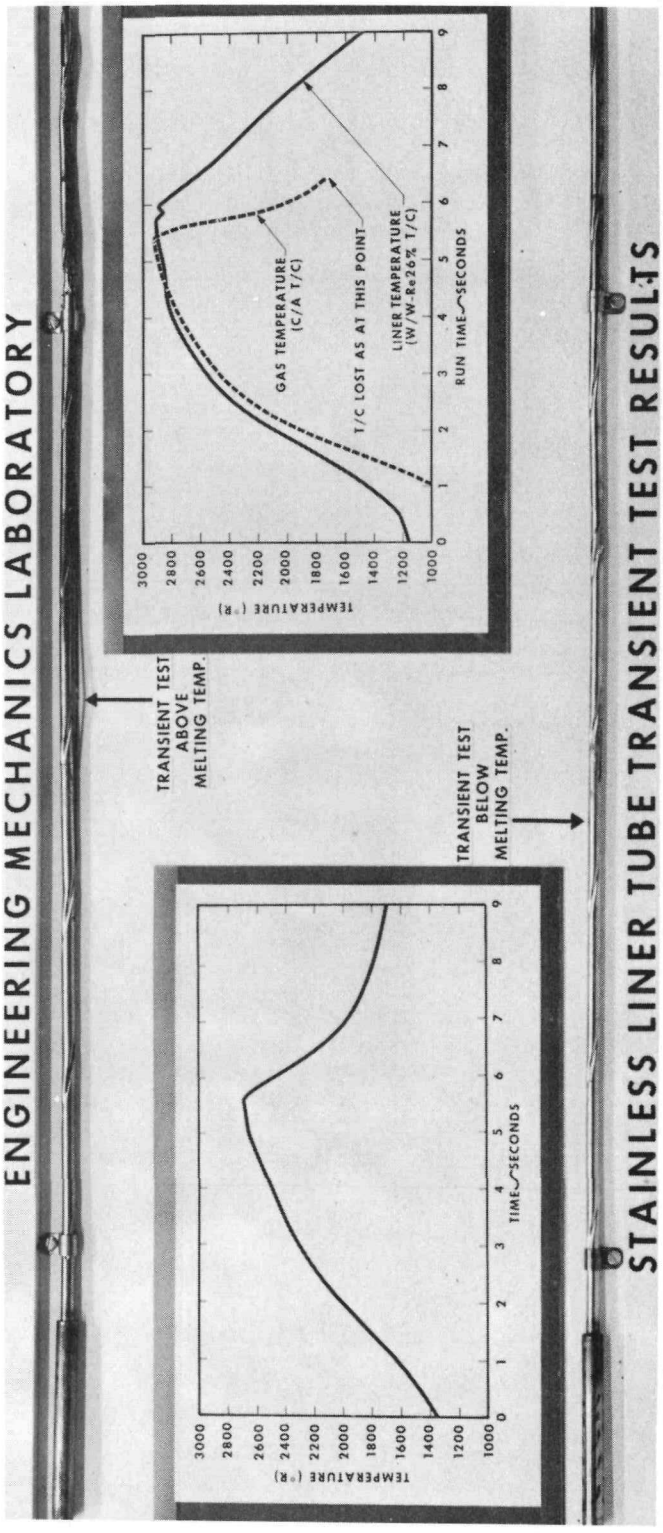




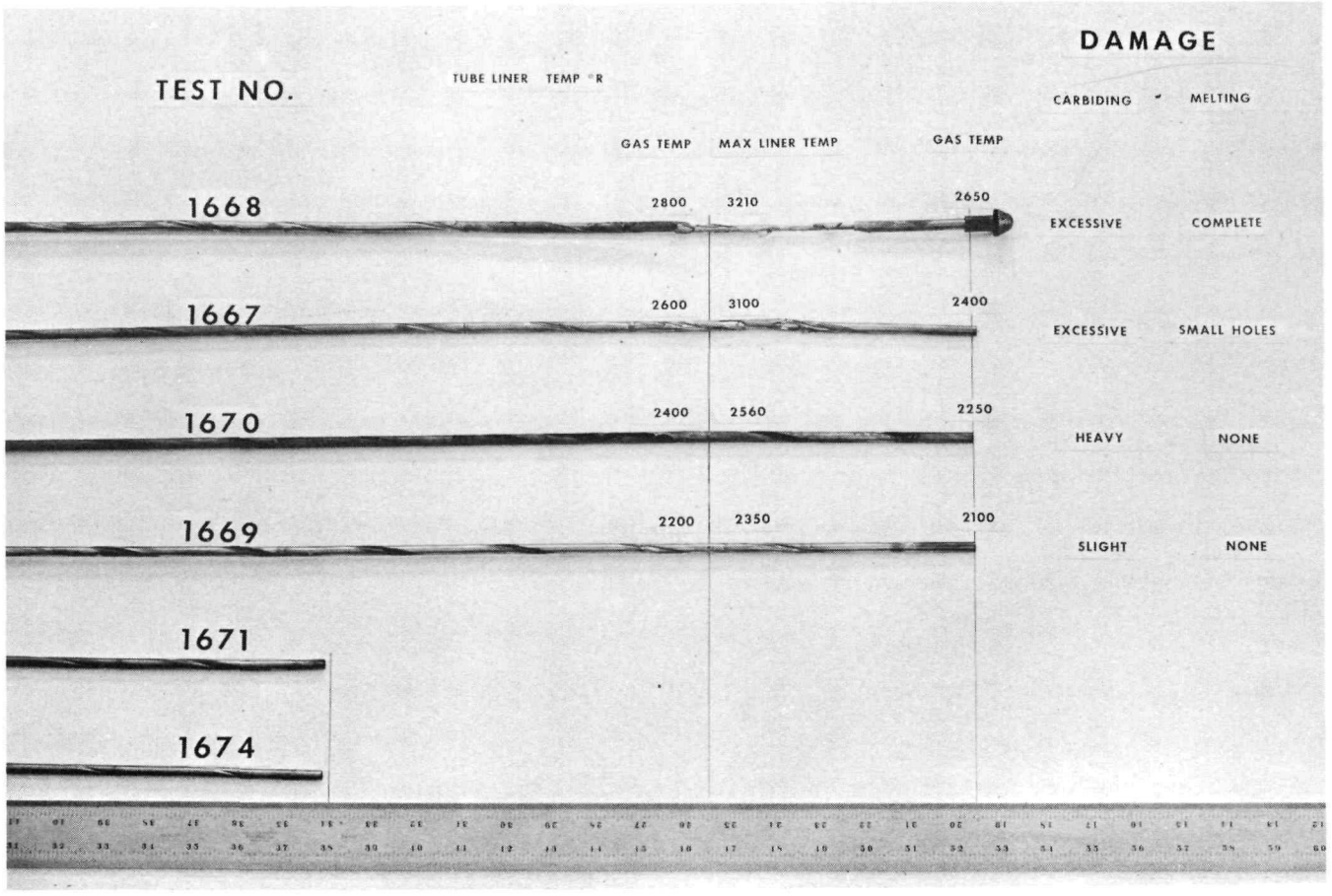
MEAS NO	RADIUS INCH	EXTRAPOLATED PEAK TEMP °R	PEAK TEMP FROM NTO DATA TAPE °R
T-750	0	2525	2430
T-763	8	2305	2470
T-799	12	2305	2340
T-760	12	2295	2430
T-768	12	2285	2230
T-766	12	2238	2300
T-769	16	2155	2130
T-765	16	1975 *	
T-775	16	1905 *	
T-755	16.3	1885 *	

* ON SCALE

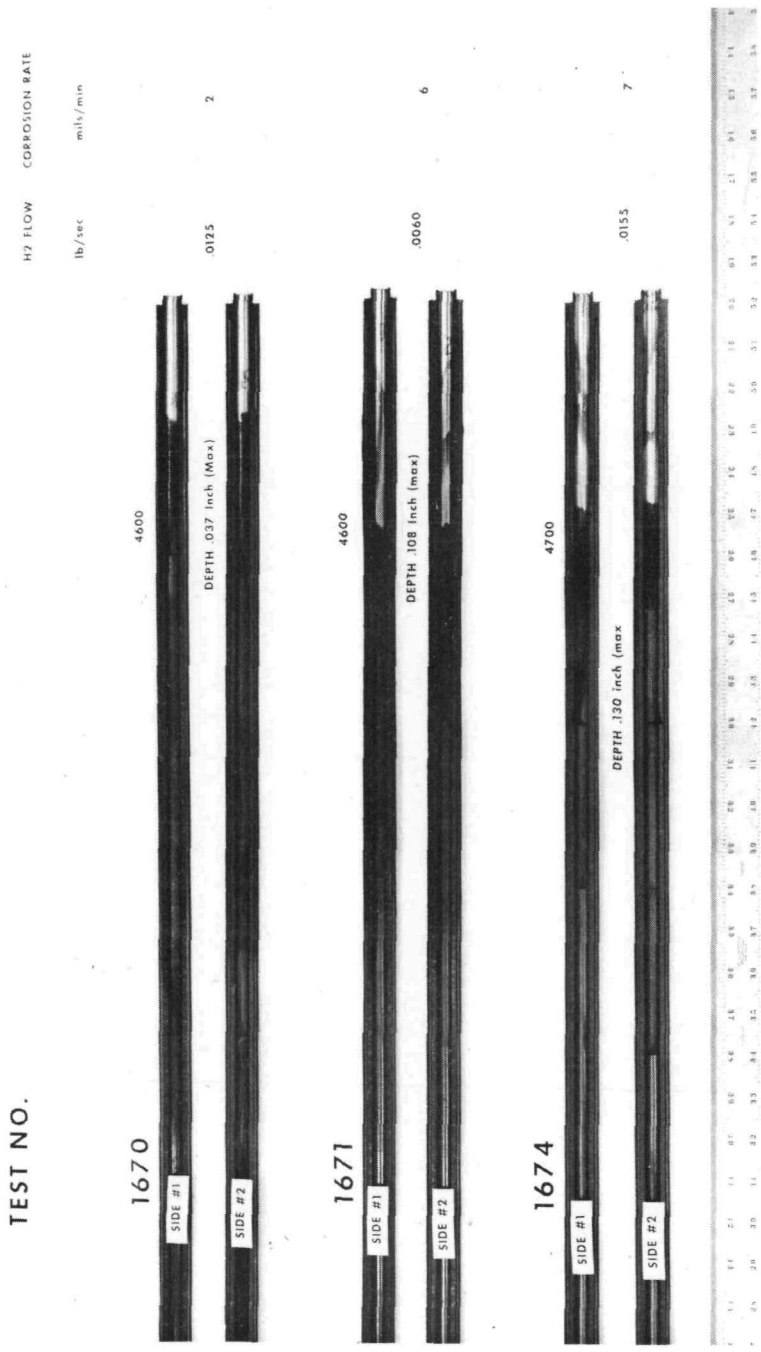
NRX-A3 EP IV TIE ROD EXIT GAS TEMPERATURES DURING SCRAM


ENGINEERING MECHANICS LABORATORY
STAINLESS LINER TUBE TRANSIENT TEST RESULTS
TRANSIENT TEST ABOVE MELTING TEMP.
TRANSIENT TEST BELOW MELTING TEMP.
TEMPERATURE (°R)
TIME—SECONDS
GAS TEMPERATURE (C/A T/C)
T/C LOST AS AT THIS POINT
LINER TEMPERATURE (W/W-Re26% T/C)
RUN TIME—SECONDS

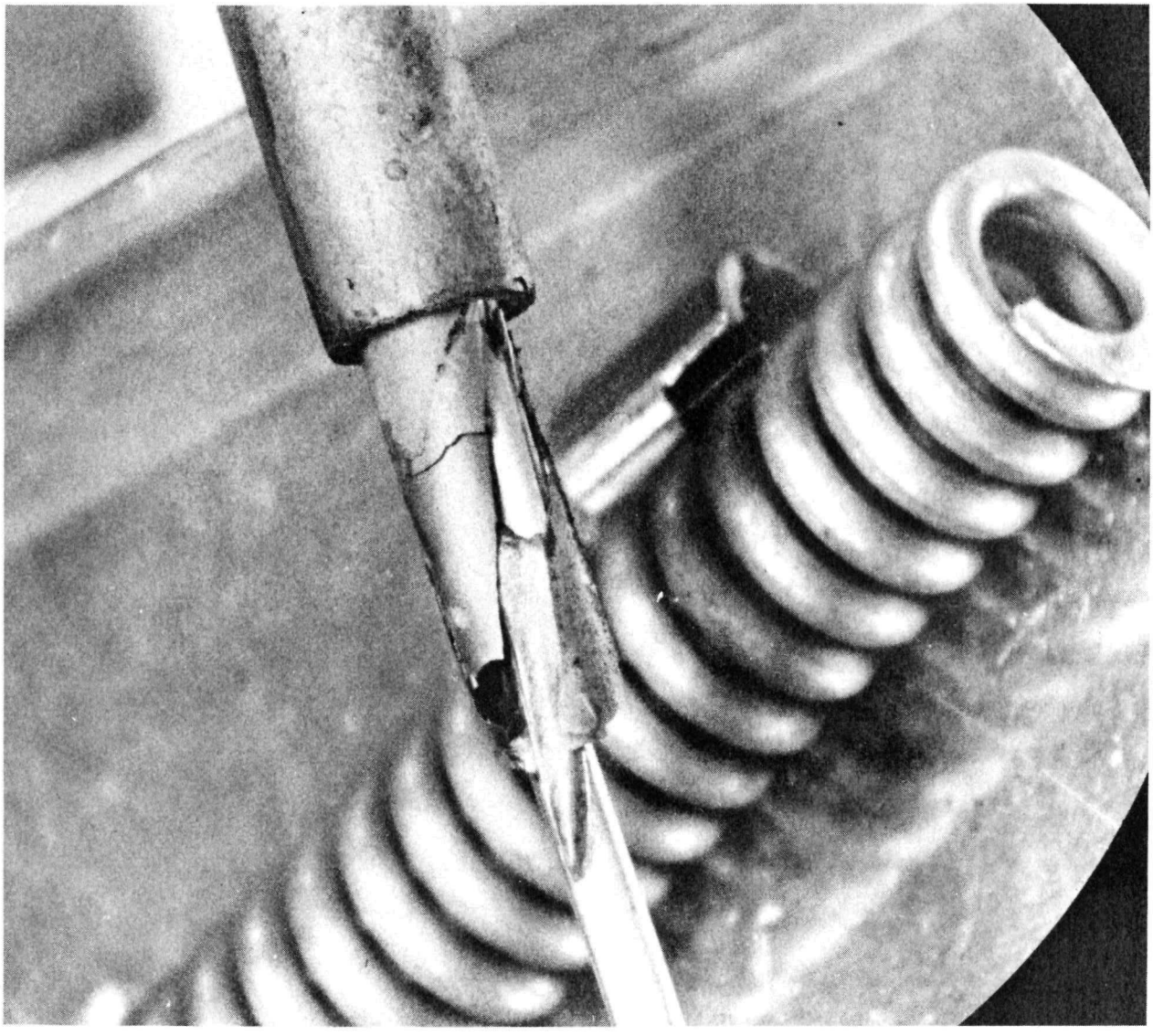
CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954



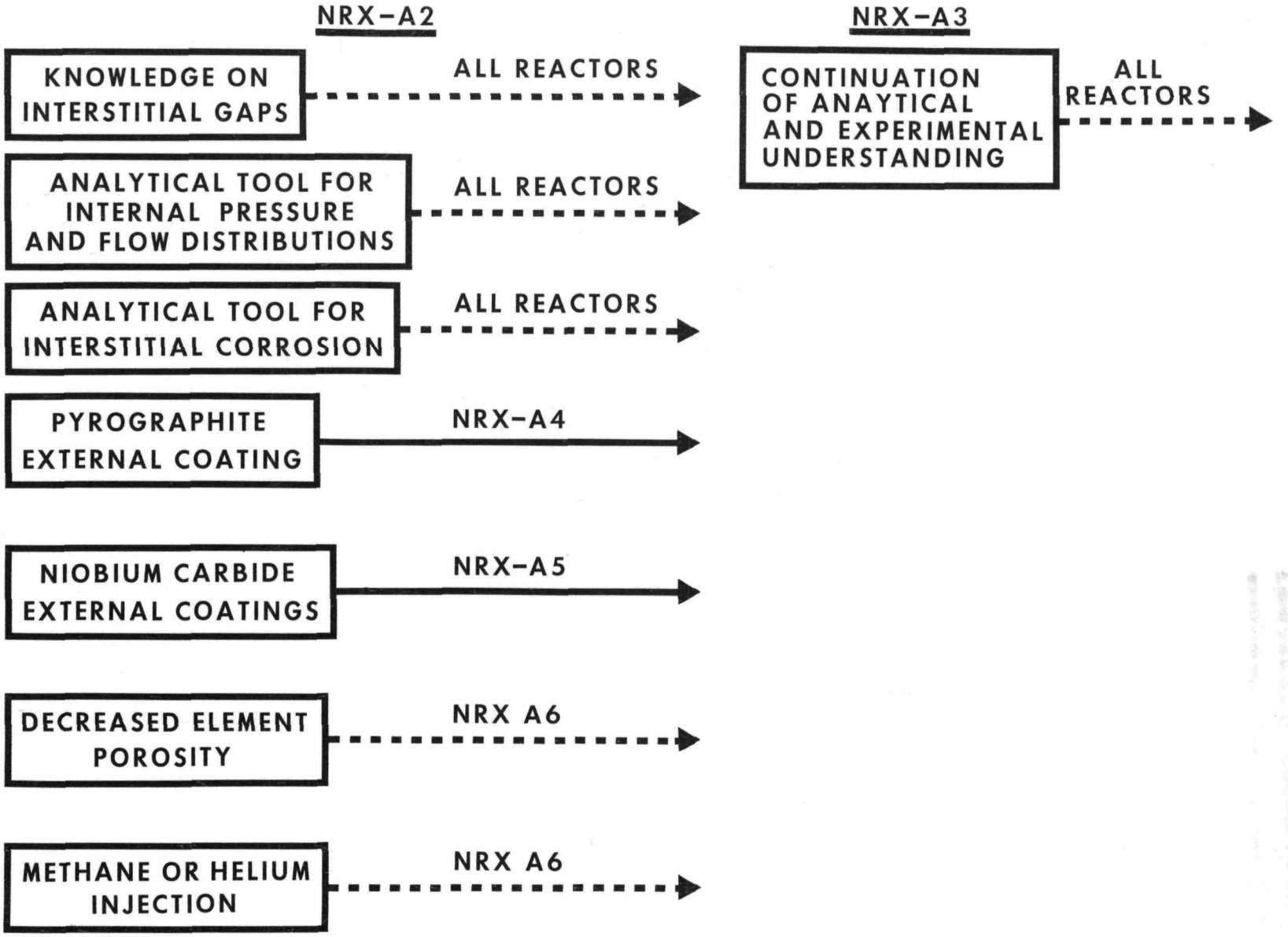
Tie Rod Liner Tubes After Exposure
to Simulated NRX-A3 Environment

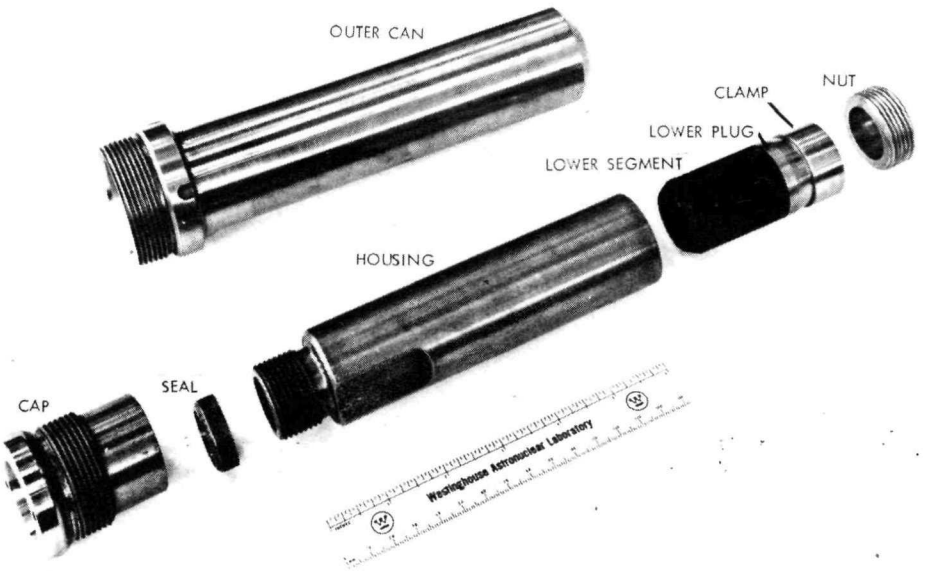


Center Elements After Exposure
to Simulated NRX-A3 Environment

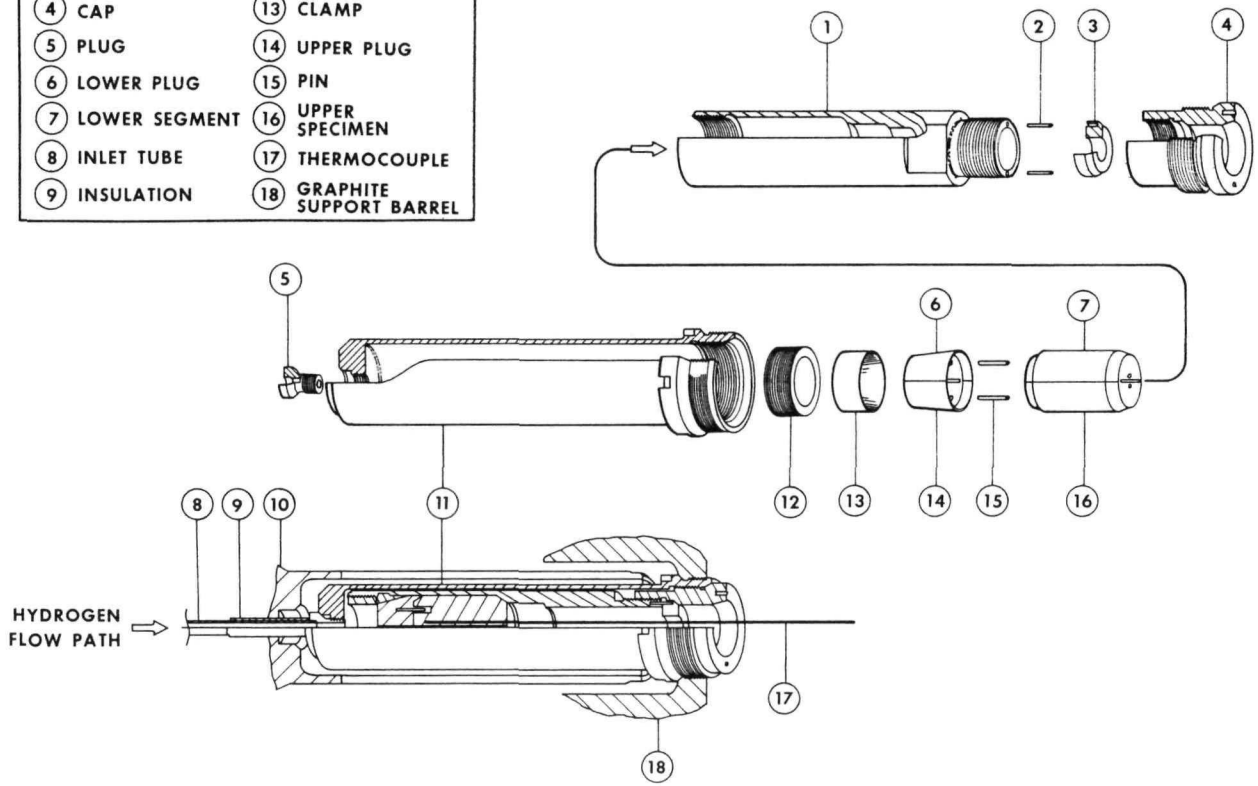


INTERSTITIAL CORROSION





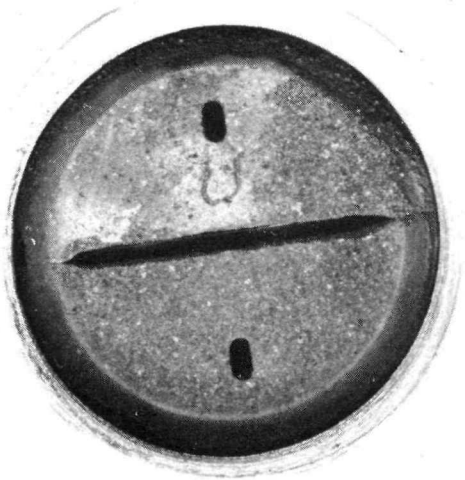
(1) HOUSING	(10) HEATER
(2) PIN	(11) OUTER CAN
(3) SEAL	(12) NUT
(4) CAP	(13) CLAMP
(5) PLUG	(14) UPPER PLUG
(6) LOWER PLUG	(15) PIN
(7) LOWER SEGMENT	(16) UPPER SPECIMEN
(8) INLET TUBE	(17) THERMOCOUPLE
(9) INSULATION	(18) GRAPHITE SUPPORT BARREL

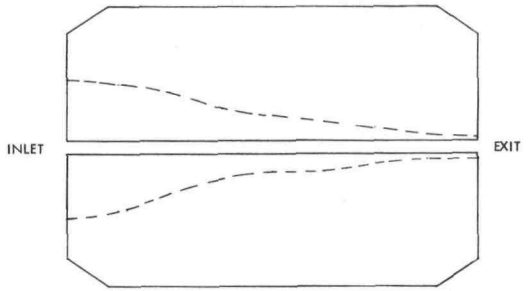


INTERSTITIAL CORROSION TESTS .006-INCH ORIGINAL GAP THICKNESS
SURFACE REGRESSION AFTER 30 MIN. RUN AT 3521°R INLET AND 3539°R EXIT

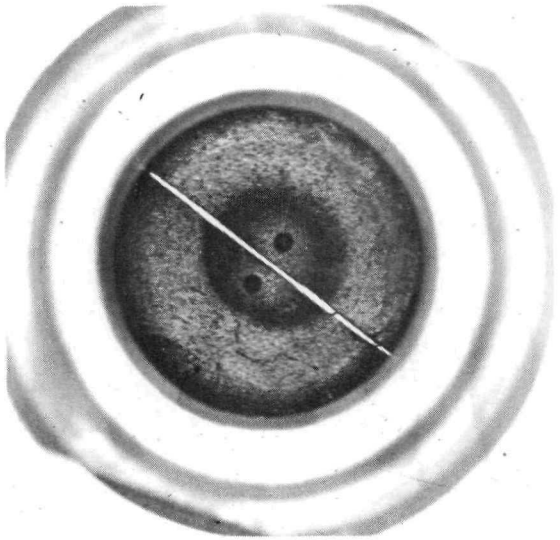
INLET PRESSURE	=	208 PSIG
FLOW RATE	=	.0000926 LB/SEC HYDROGEN
GAP LENGTH	=	2-INCHES
GAP WIDTH	=	1-INCH
WEIGHT LOSS	=	2.363 GMS

INLET OF .006-INCH GAP
TEST FIXTURE AFTER TEST



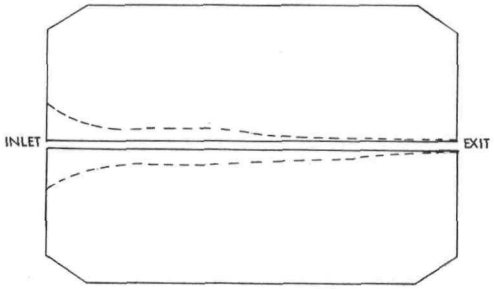


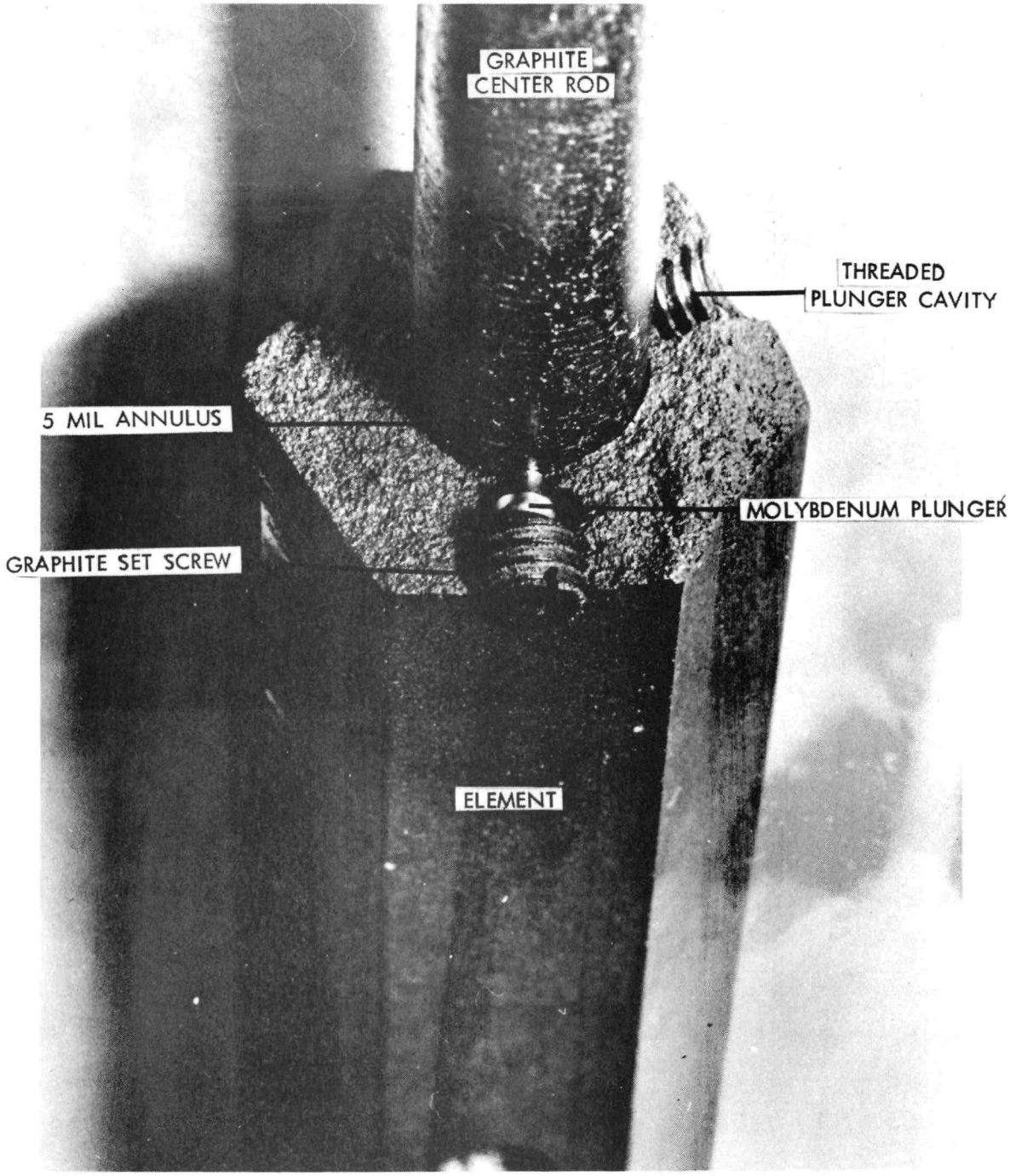
EXIT OF .006-INCH GAP
TEST FIXTURE AFTER TEST

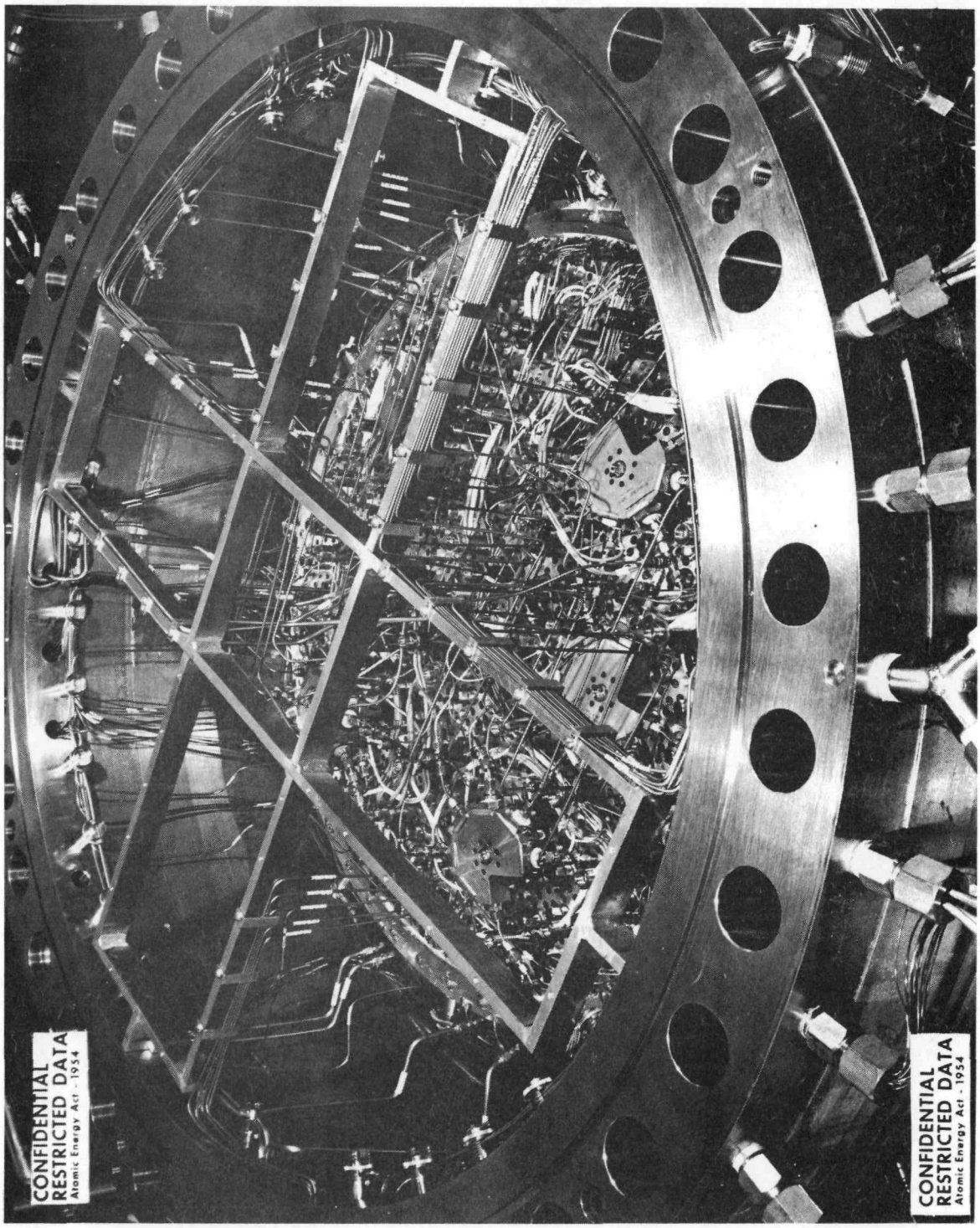


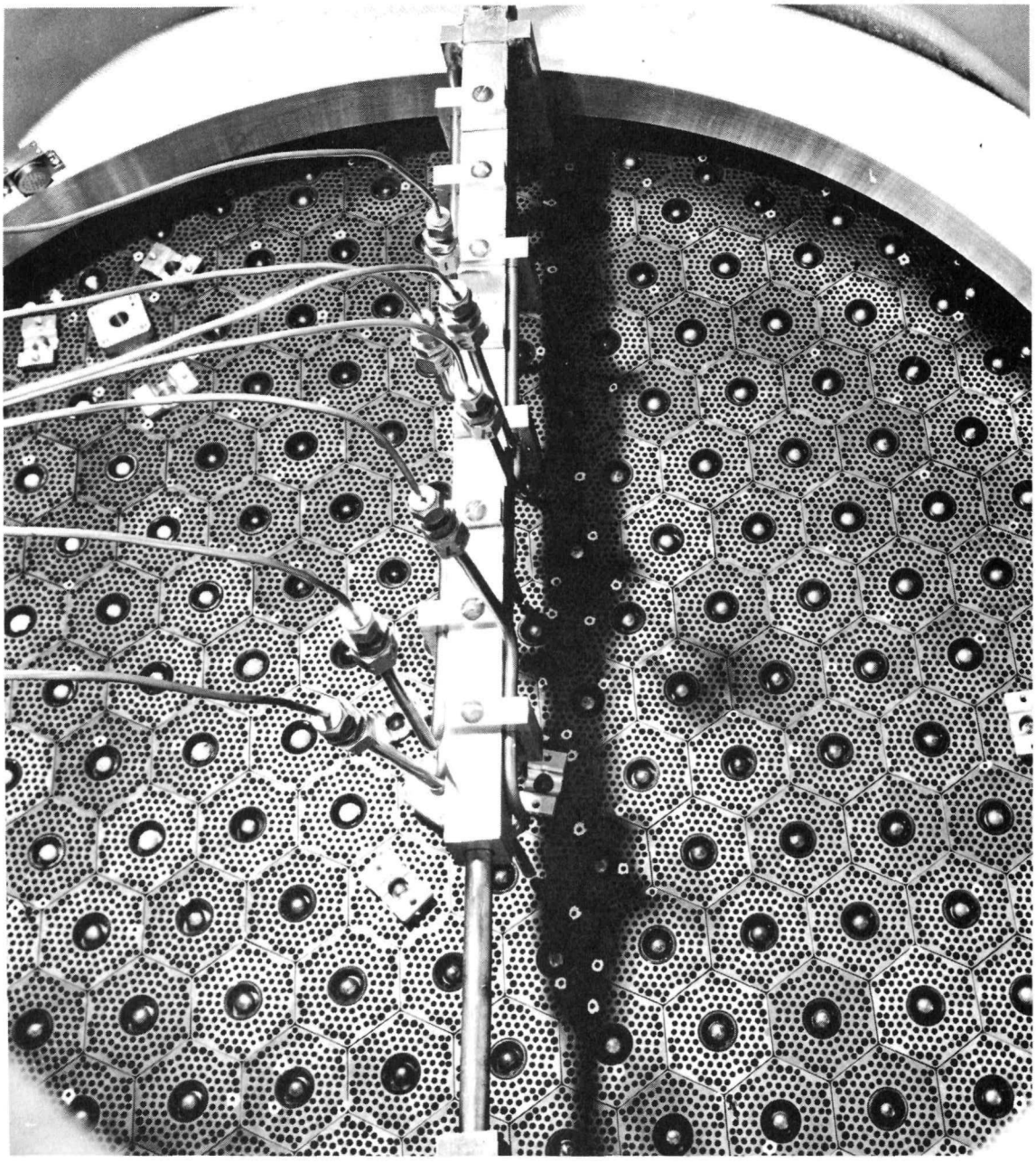
INTERSTITIAL CORROSION TEST .004-INCH ORIGINAL GAP THICKNESS
SURFACE REGRESSION AFTER 27 MIN. RUN AT 3443°R INLET AND 3485°R EXIT

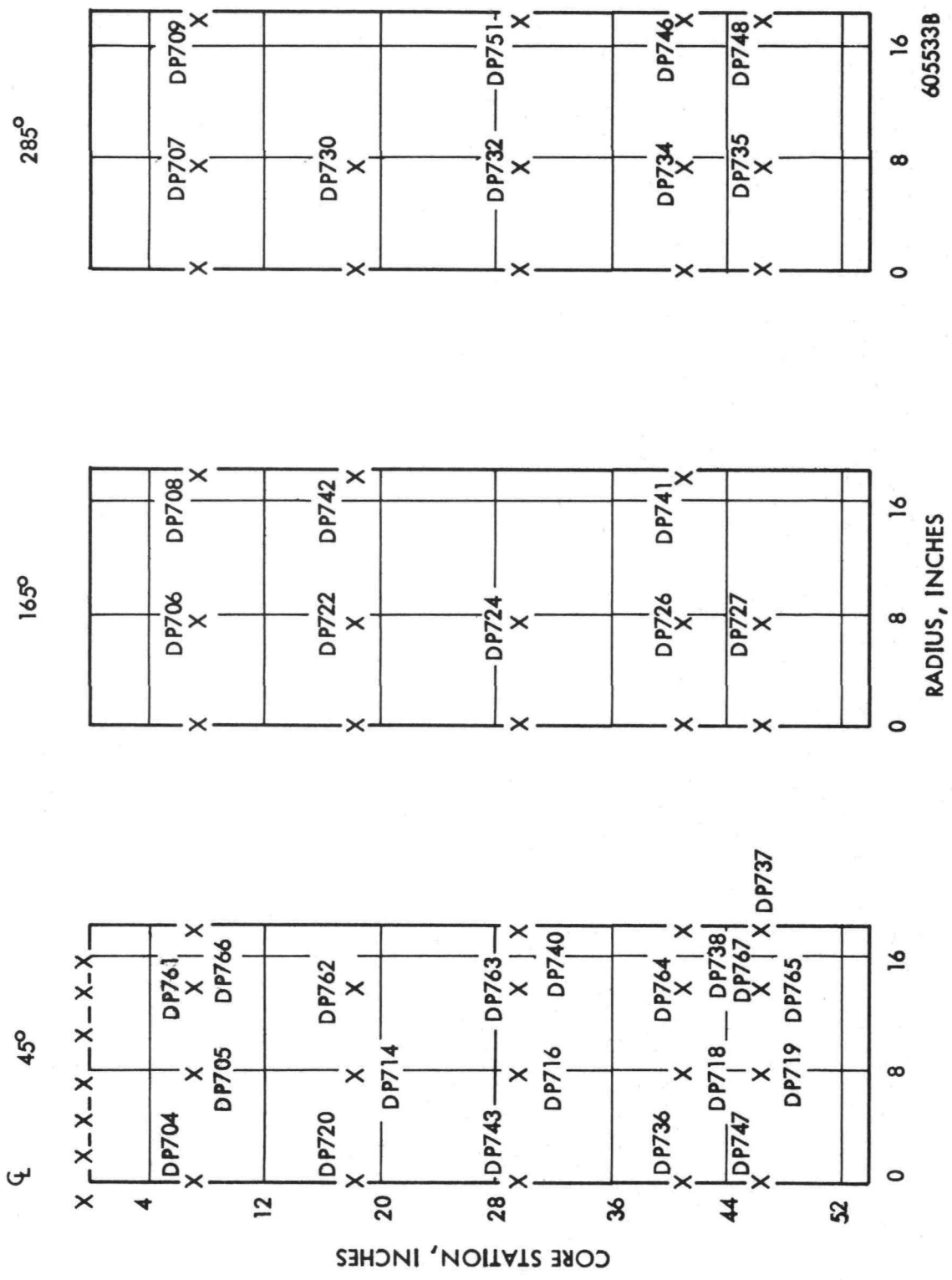
INLET PRESSURE	=	222 PSIG
FLOW RATE	=	.0000973 LB/SEC HYDROGEN
GAP LENGTH	=	2-INCHES
GAP WIDTH	=	1-INCH
WEIGHT LOSS	=	1.966 GMS.

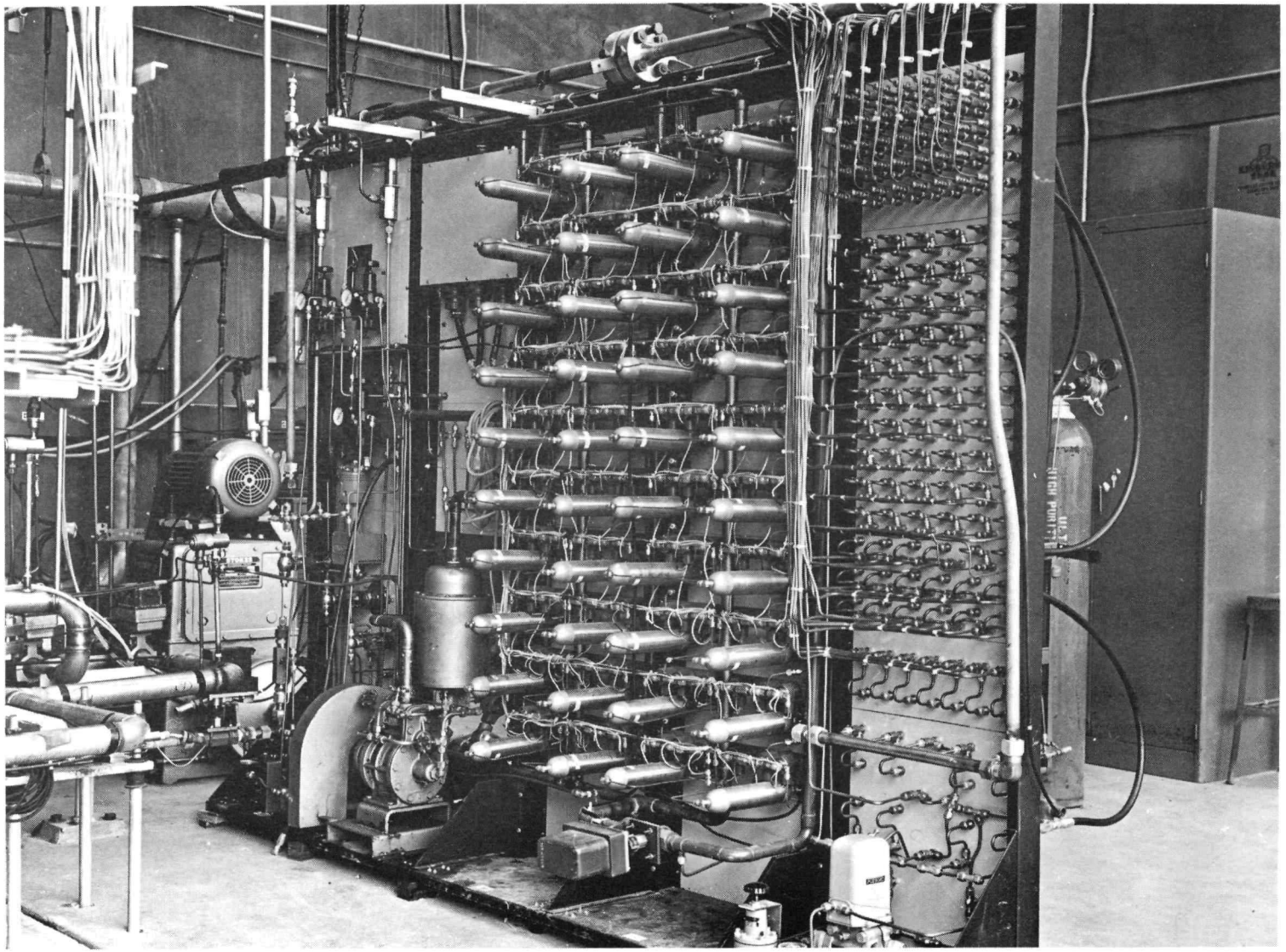


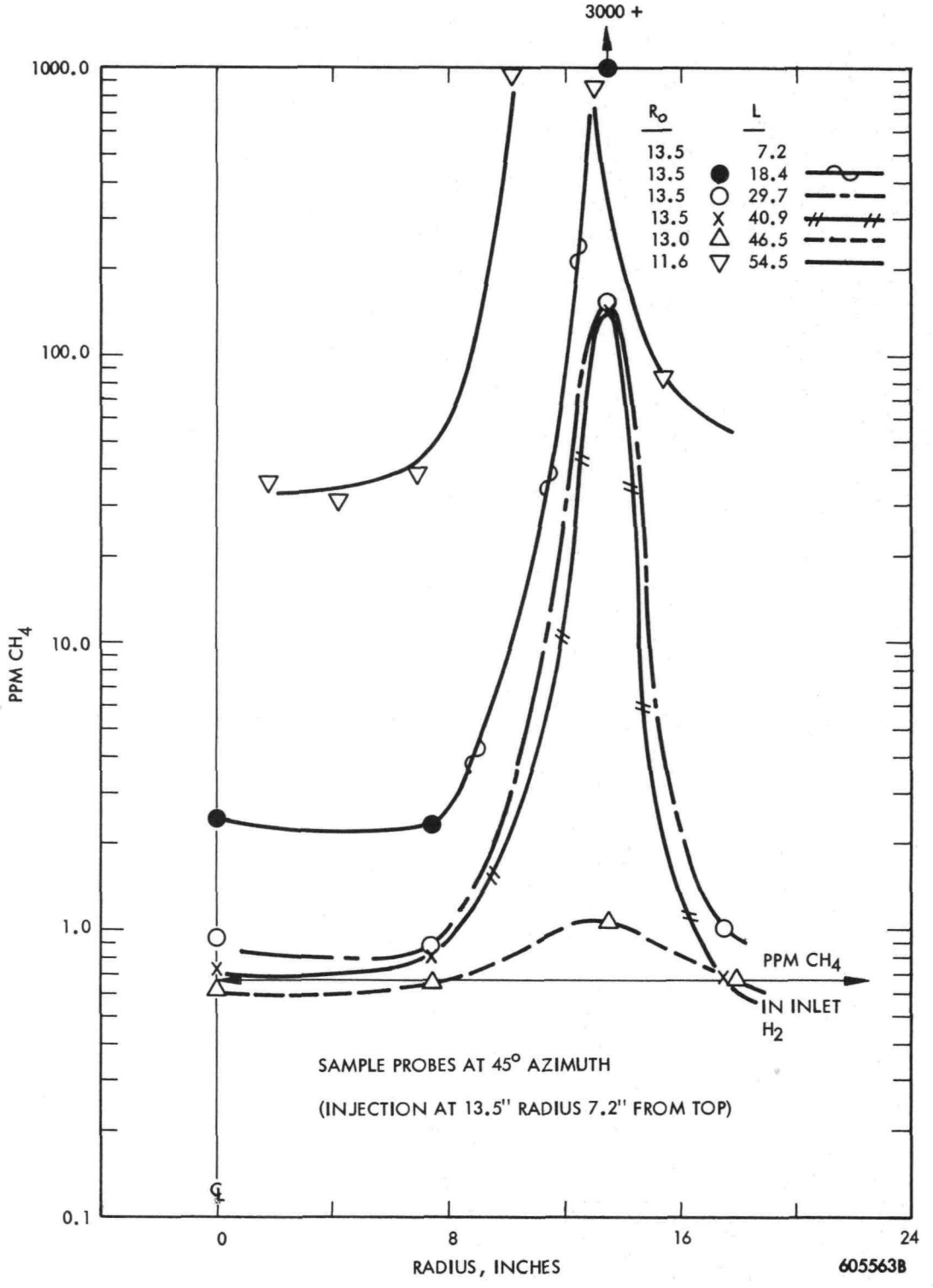

GRAPHITE
CENTER ROD
THREADED
PLUNGER CAVITY
5 MIL ANNULUS
MOLYBDENUM PLUNGER
GRAPHITE SET SCREW
ELEMENT

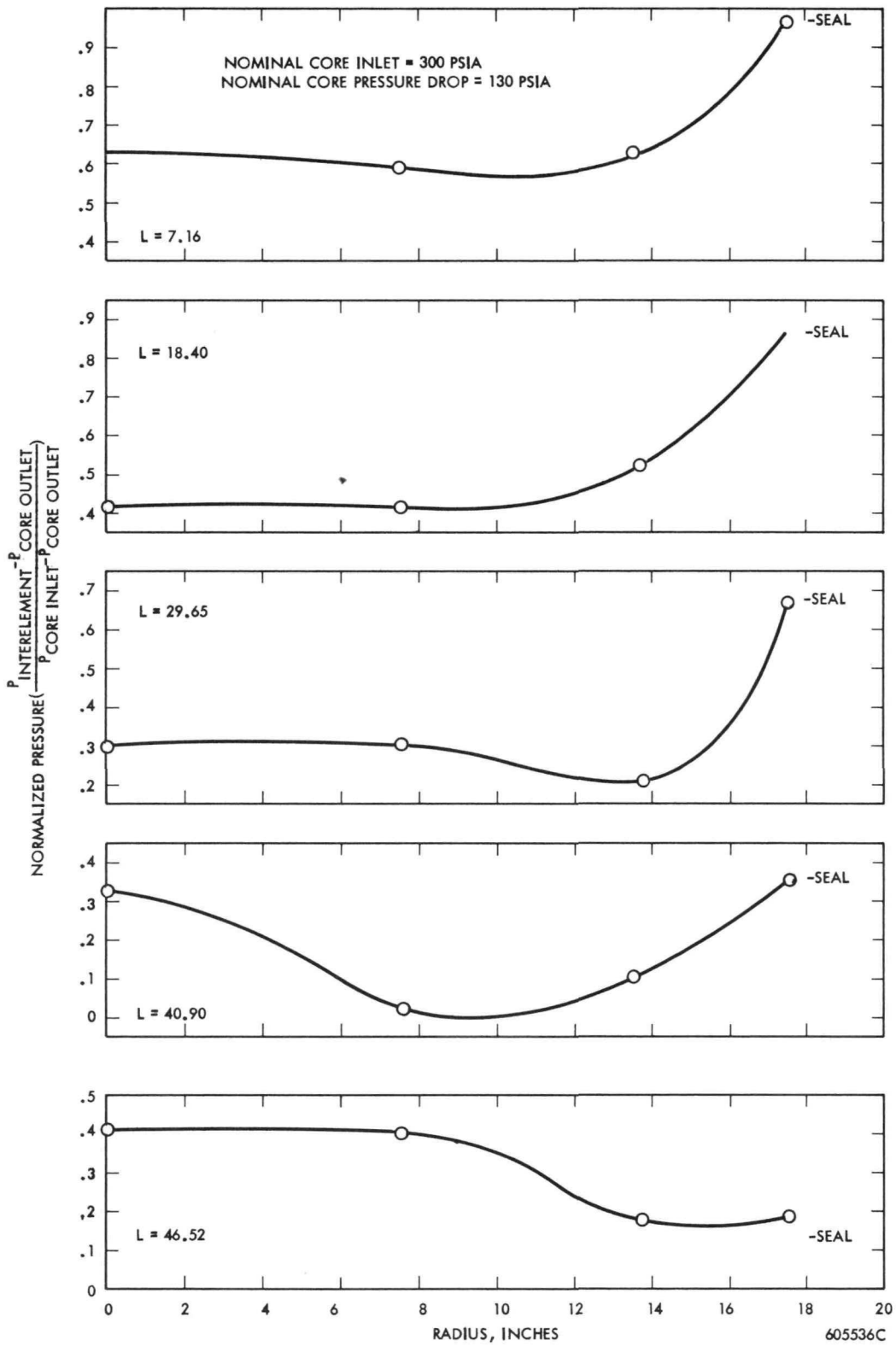

CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954
CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954

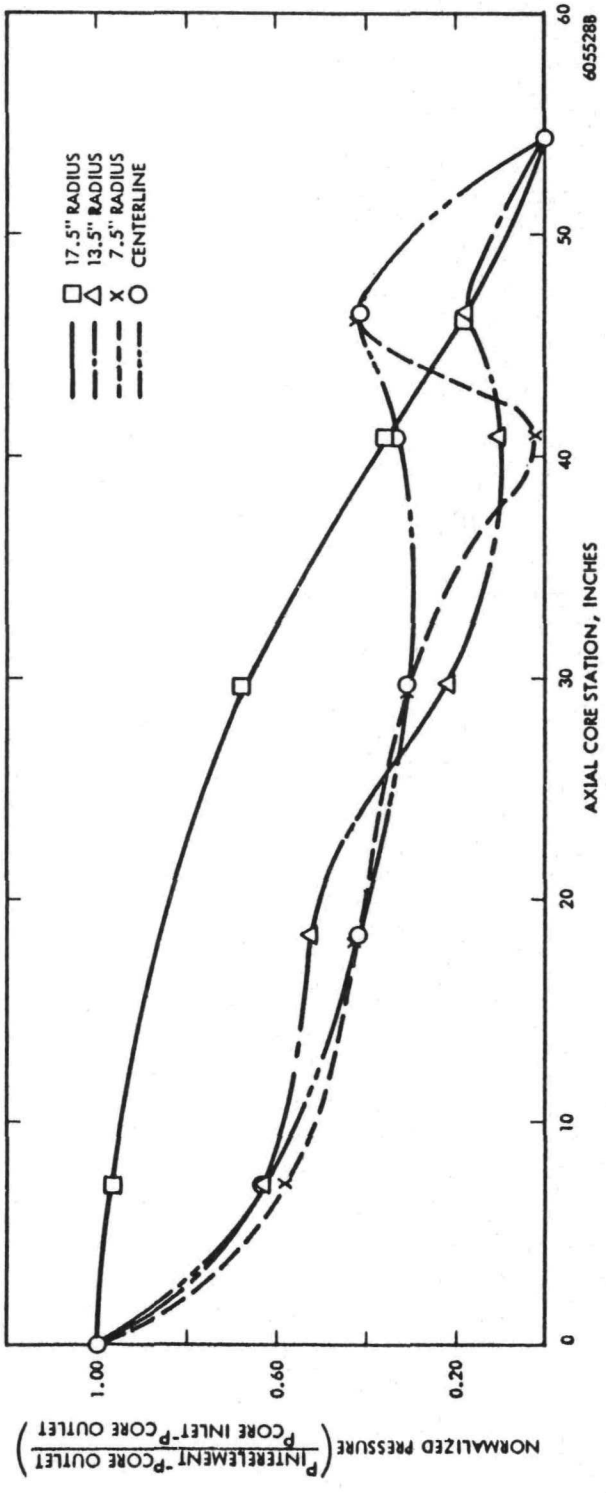



285°
DP707
DP709
DP730
DP732
DP751
DP734
DP746
DP735
DP748
165°
DP706
DP708
DP722
DP742
DP724
DP726
DP741
DP727
℄
45°
DP704
DP761
DP766
DP705
DP720
DP762
DP714
DP743
DP763
DP716
DP740
DP736
DP764
DP718
DP738
DP747
DP767
DP737
DP719
DP765
4
12
20
28
36
44
52
0
8
16
RADIUS, INCHES
CORE STATION, INCHES
605533B

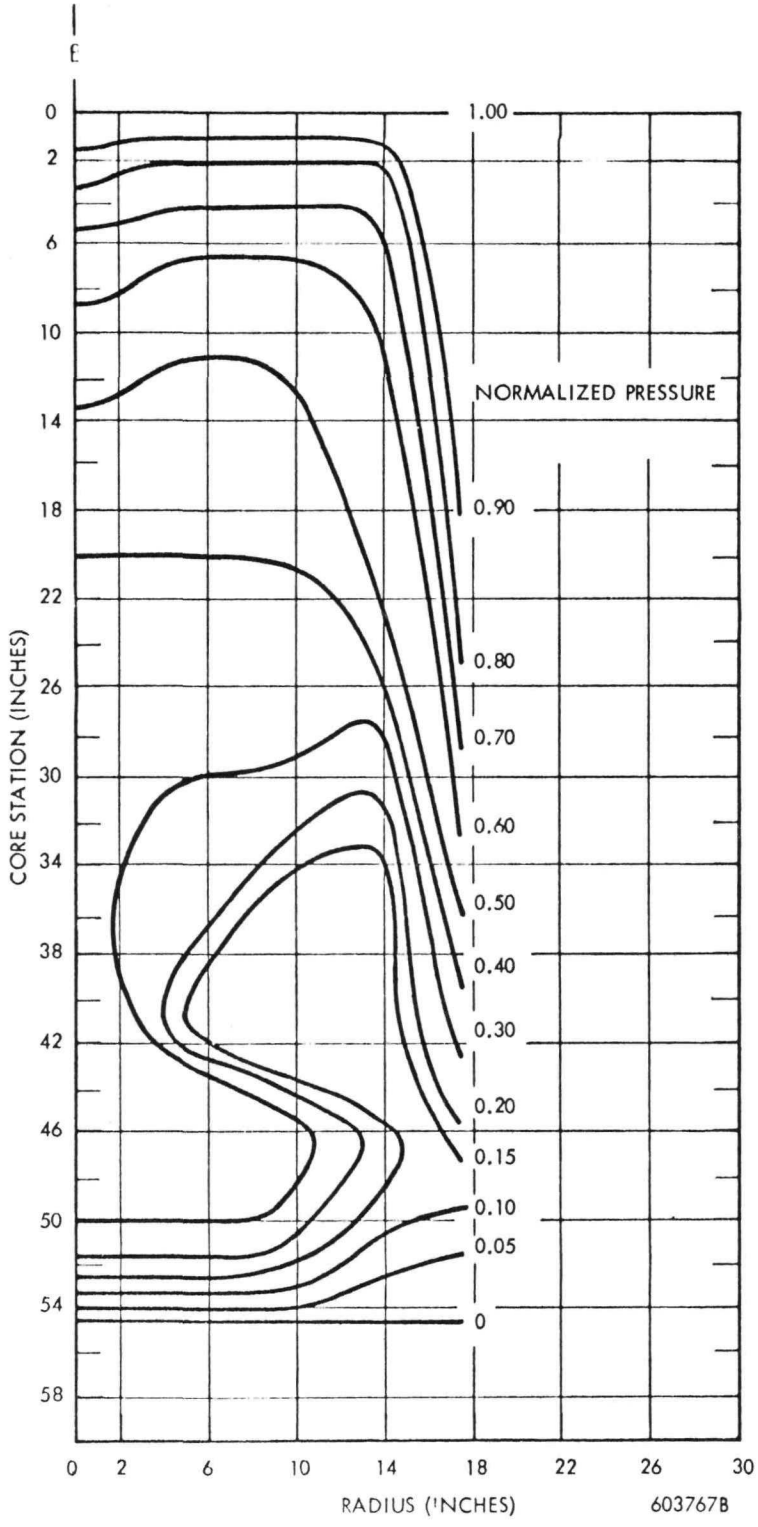



3000 +
1000.0
100.0
10.0
1.0
0.1
PPM CH_4
R_o
L
13.5 7.2
13.5 18.4
13.5 29.7
13.5 40.9
13.0 46.5
11.6 54.5
PPM CH_4
IN INLET
H_2
SAMPLE PROBES AT 45° AZIMUTH
(INJECTION AT 13.5" RADIUS 7.2" FROM TOP)
0
8
16
24
RADIUS, INCHES
605563B

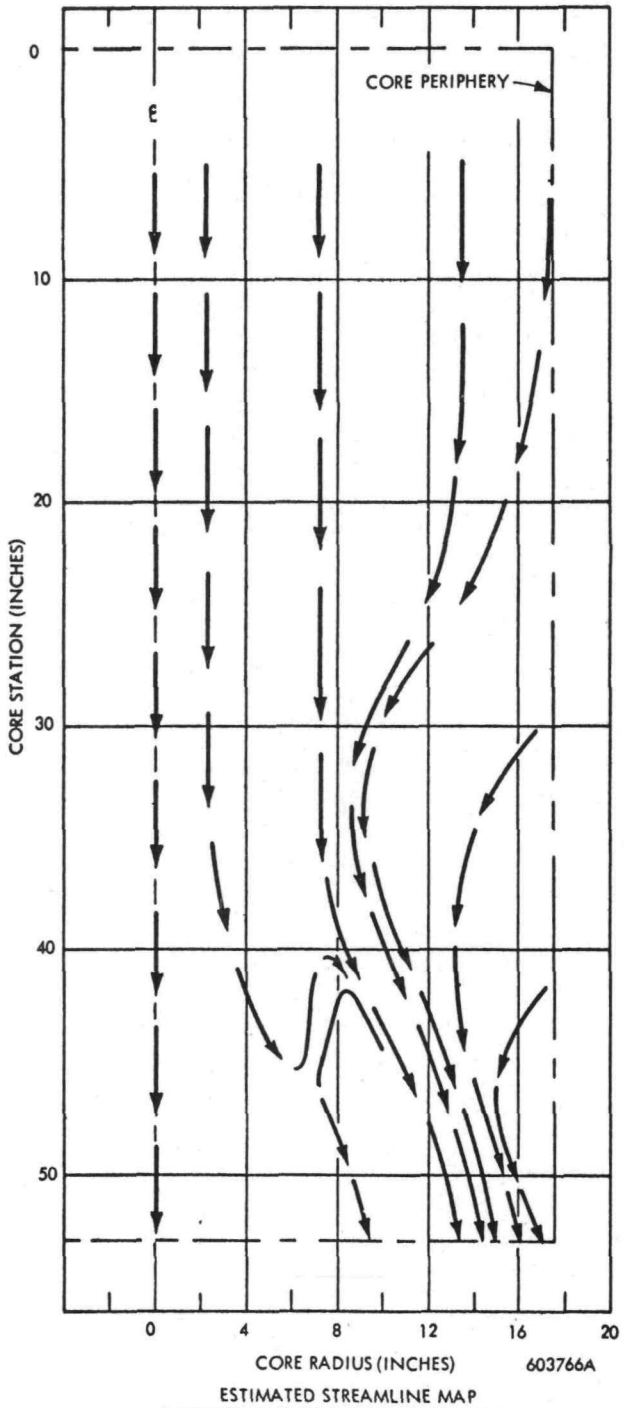

NOMINAL CORE INLET = 300 PSIA
NOMINAL CORE PRESSURE DROP = 130 PSIA
L = 7.16
L = 18.40
L = 29.65
L = 40.90
L = 46.52
-SEAL
NORMALIZED PRESSURE (P INTERELEMENT - P CORE OUTLET / P CORE INLET - P CORE OUTLET)
RADIUS, INCHES
605536C



PLUGGED CORE FLOW TEST



ISOBAR MAP OF CORE
PLUGGED CORE FLOW TEST

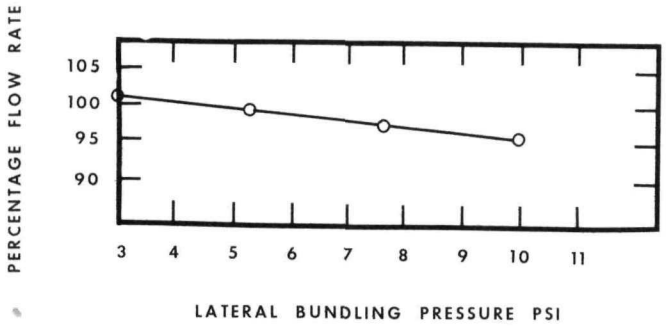


ESTIMATED STREAMLINE MAP
PLUGGED CORE TRACER GAS TEST SERIES

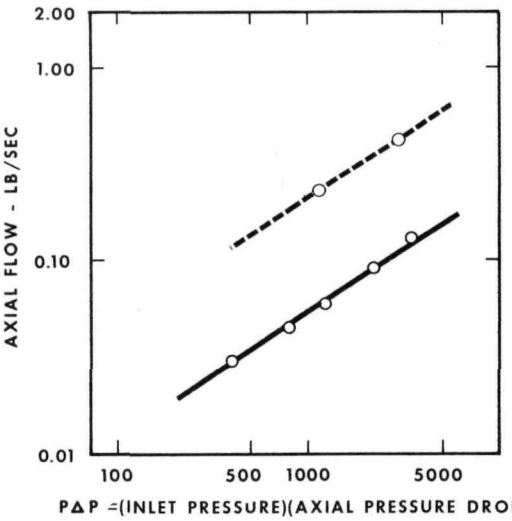
CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954

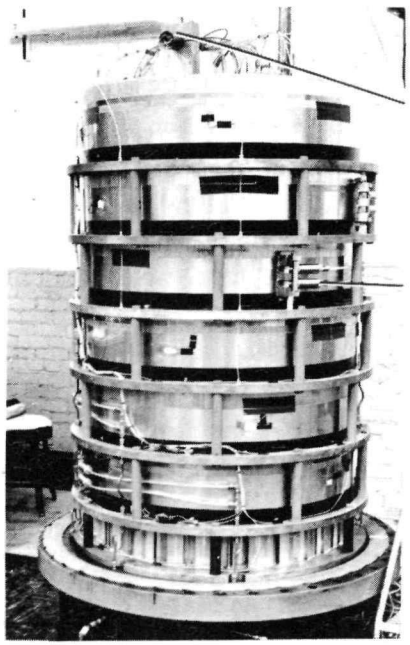
CORE EFFECTIVE GAP EXPERIMENTS

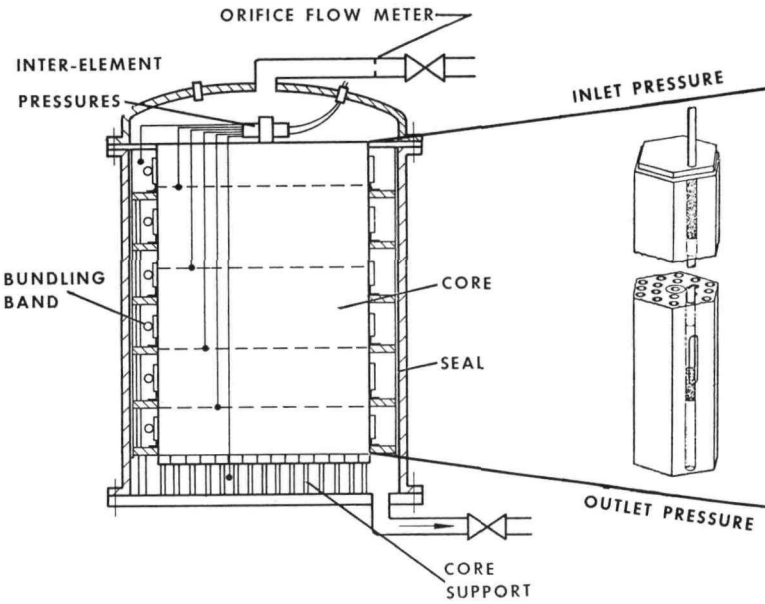
EFFECT OF BUNDLING ON FLOW



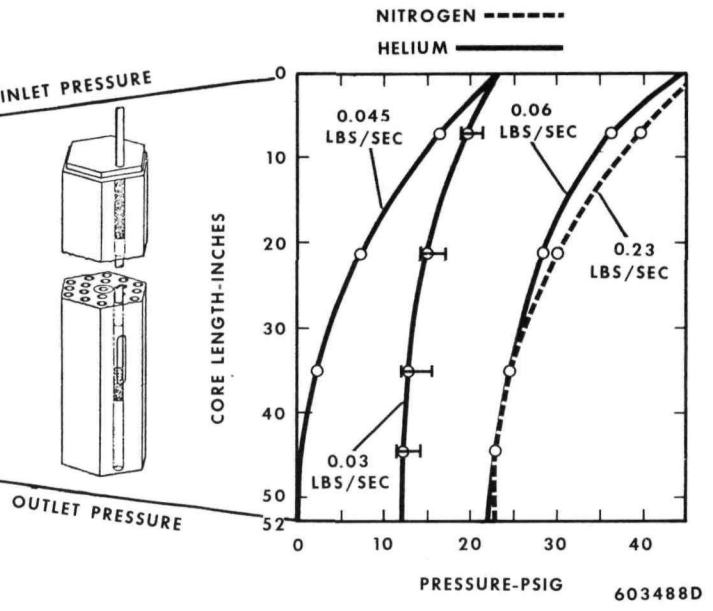
INTERELEMENT FLOW RATE





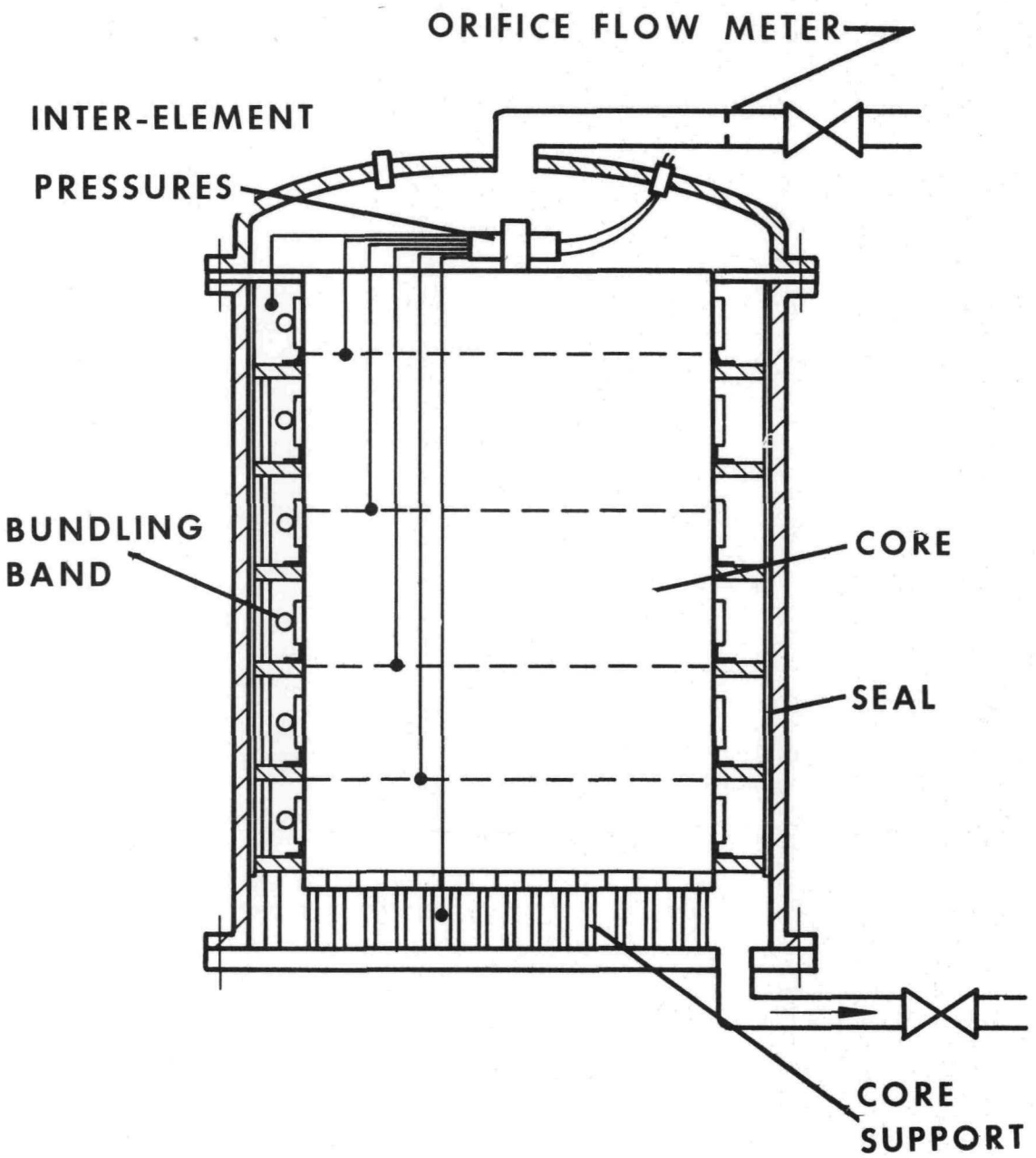


CORE EFFECTIVE GAP SCHEMATIC



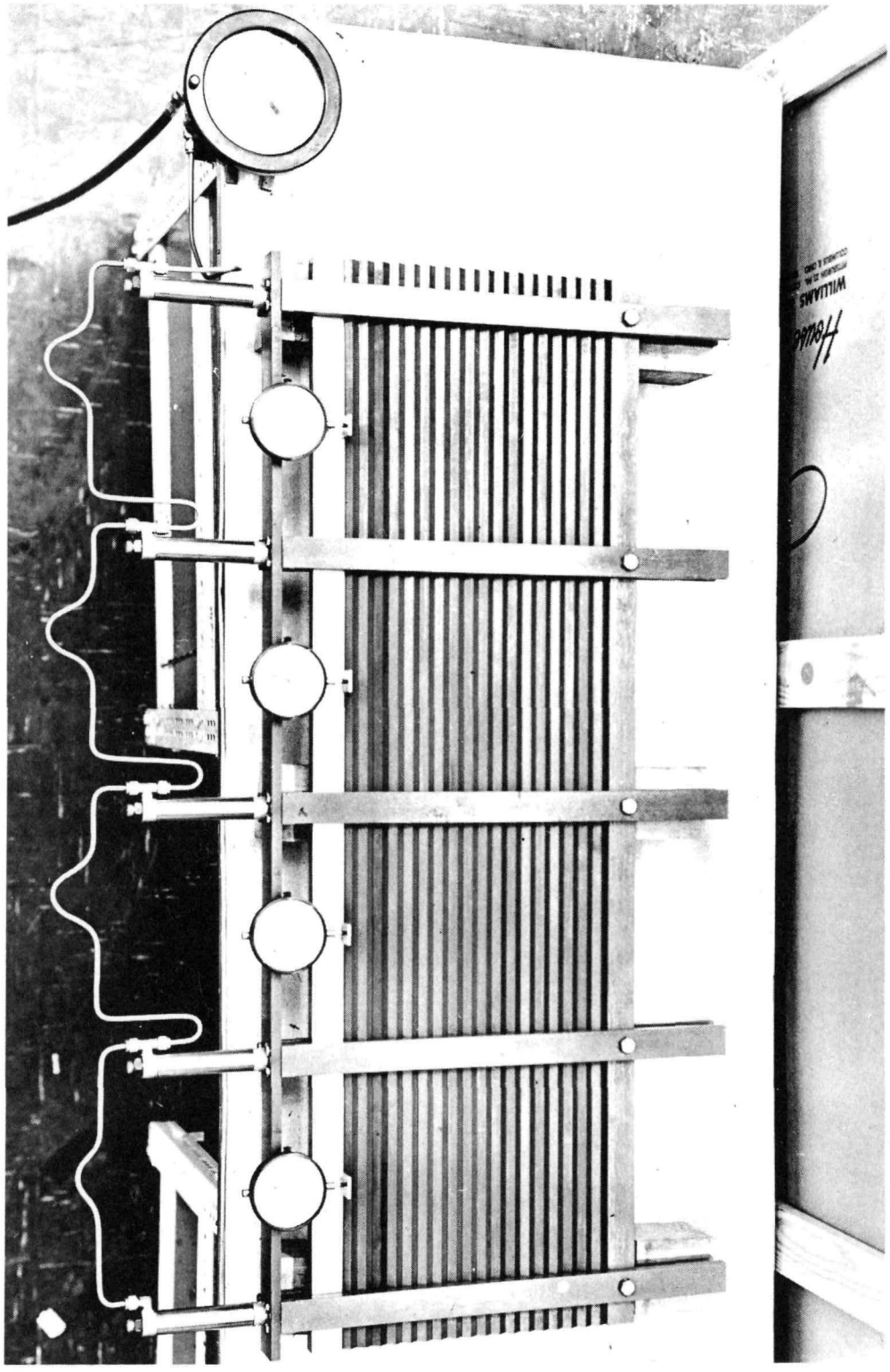
INTERELEMENT PRESSURE PROFILE

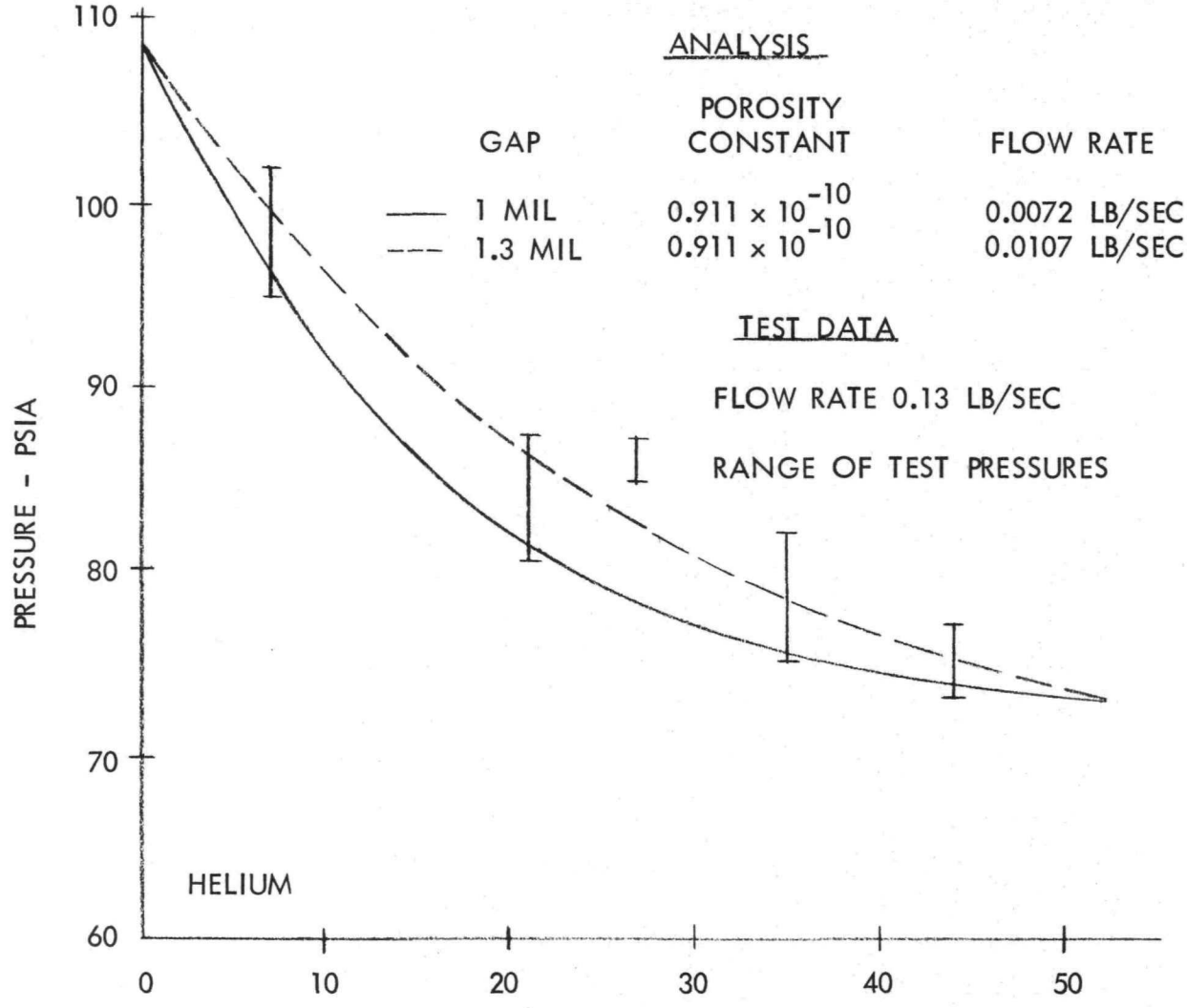
Astronuclear Laboratory



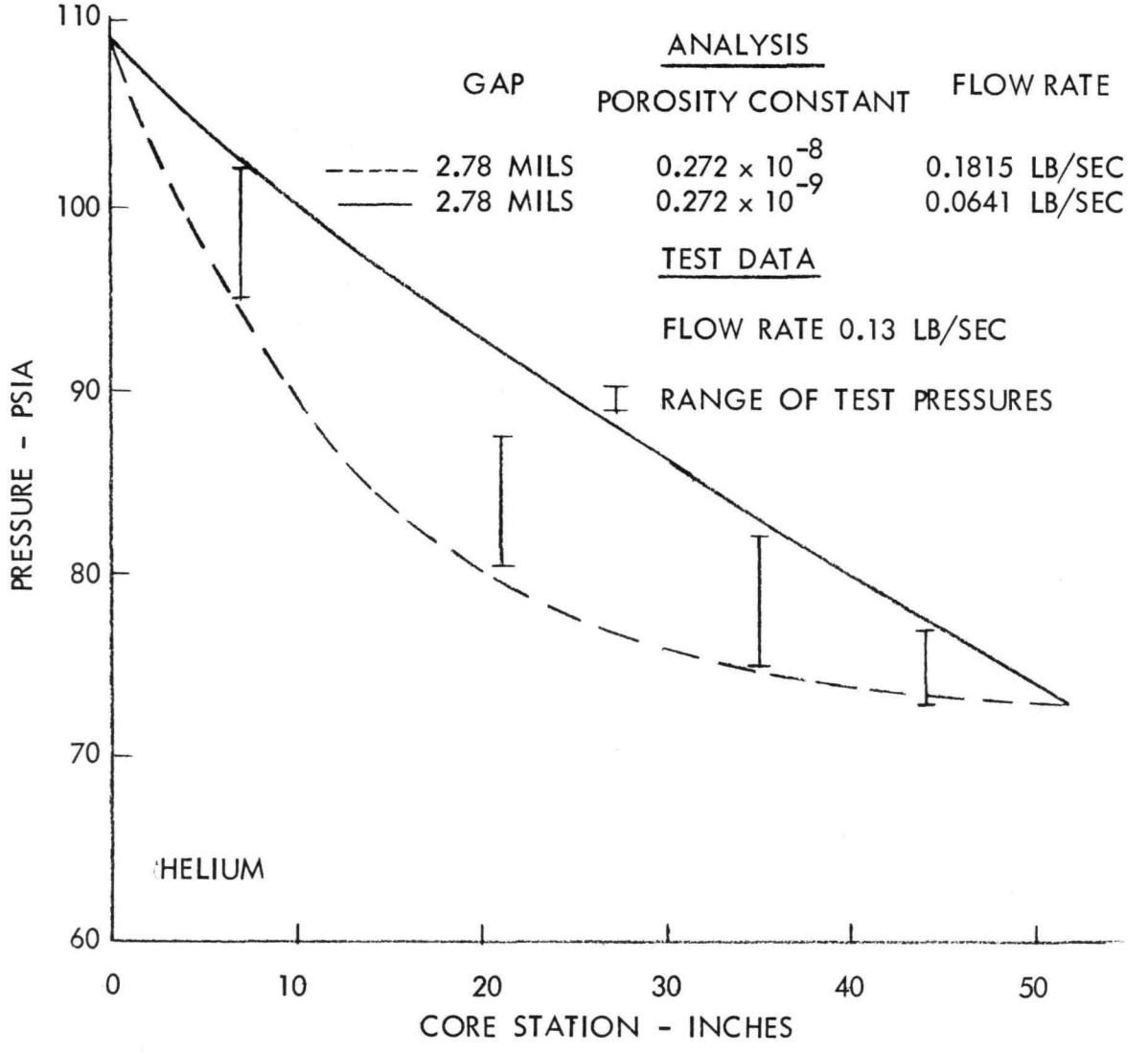
CORE EFFECTIVE GAP SCHEMATIC

603806

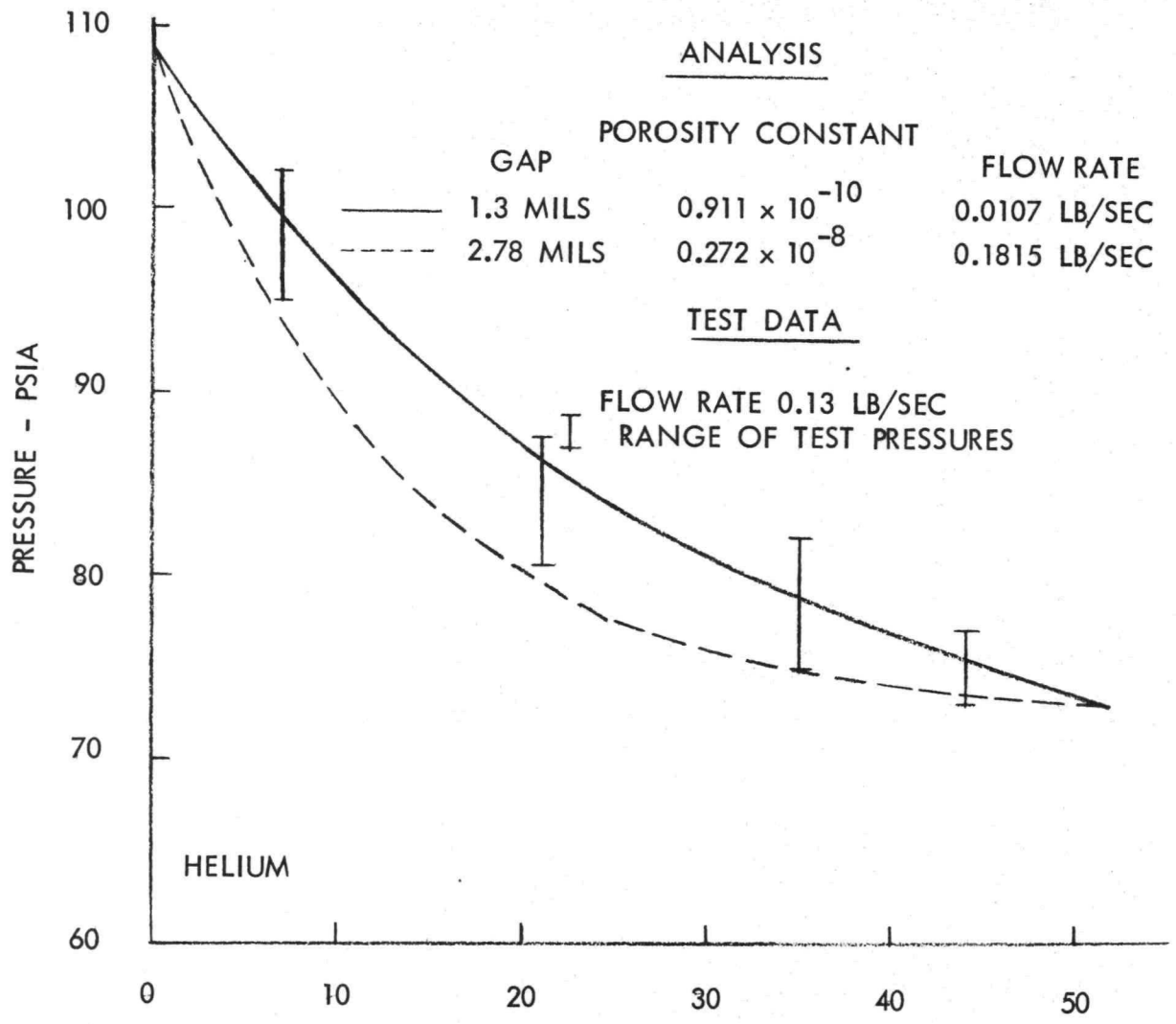




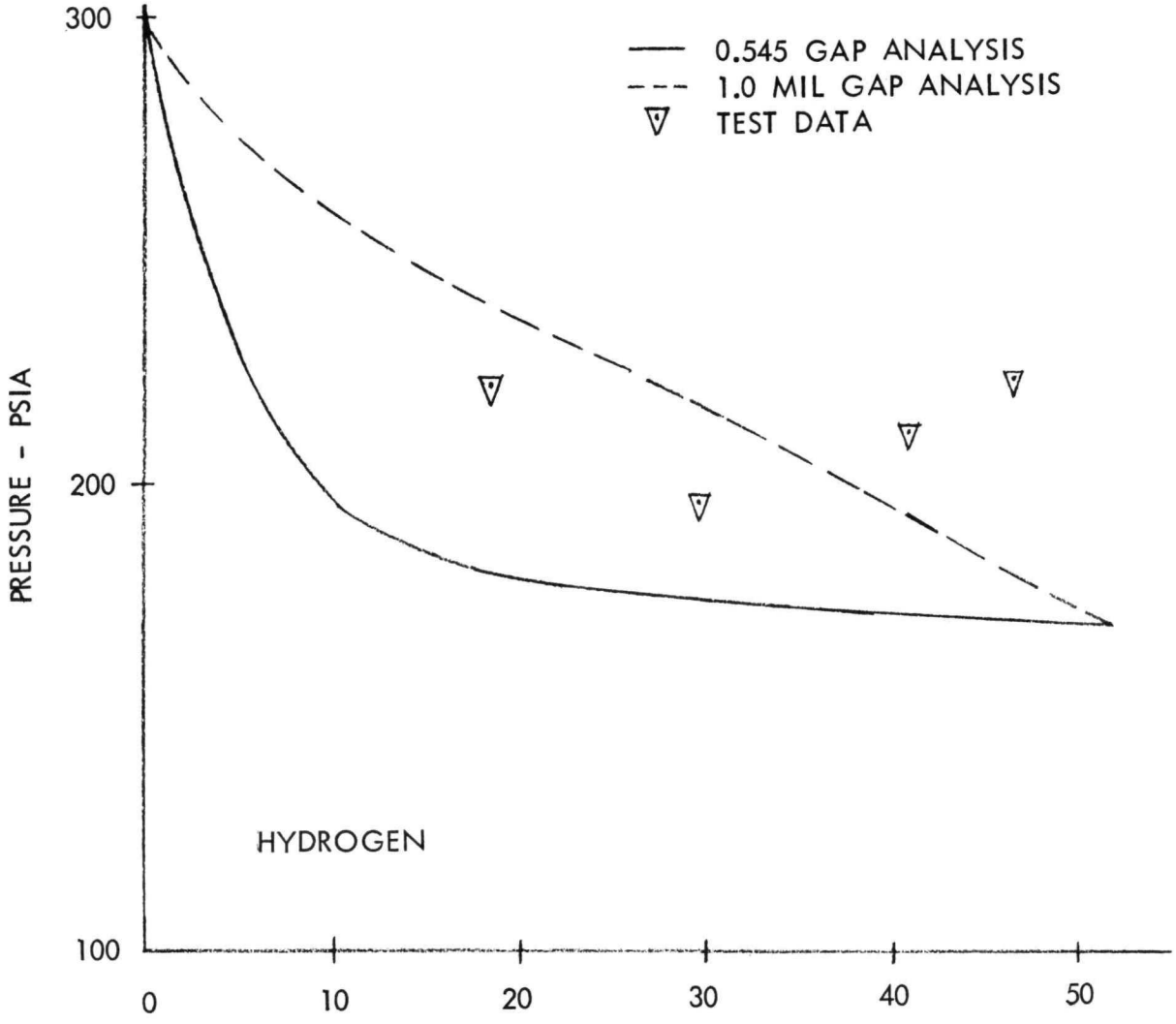
CORE EFFECTIVE GAP TEST COMPARISON OF TEST DATA AND ANALYSIS EFFECT OF INTERELEMENT GAP



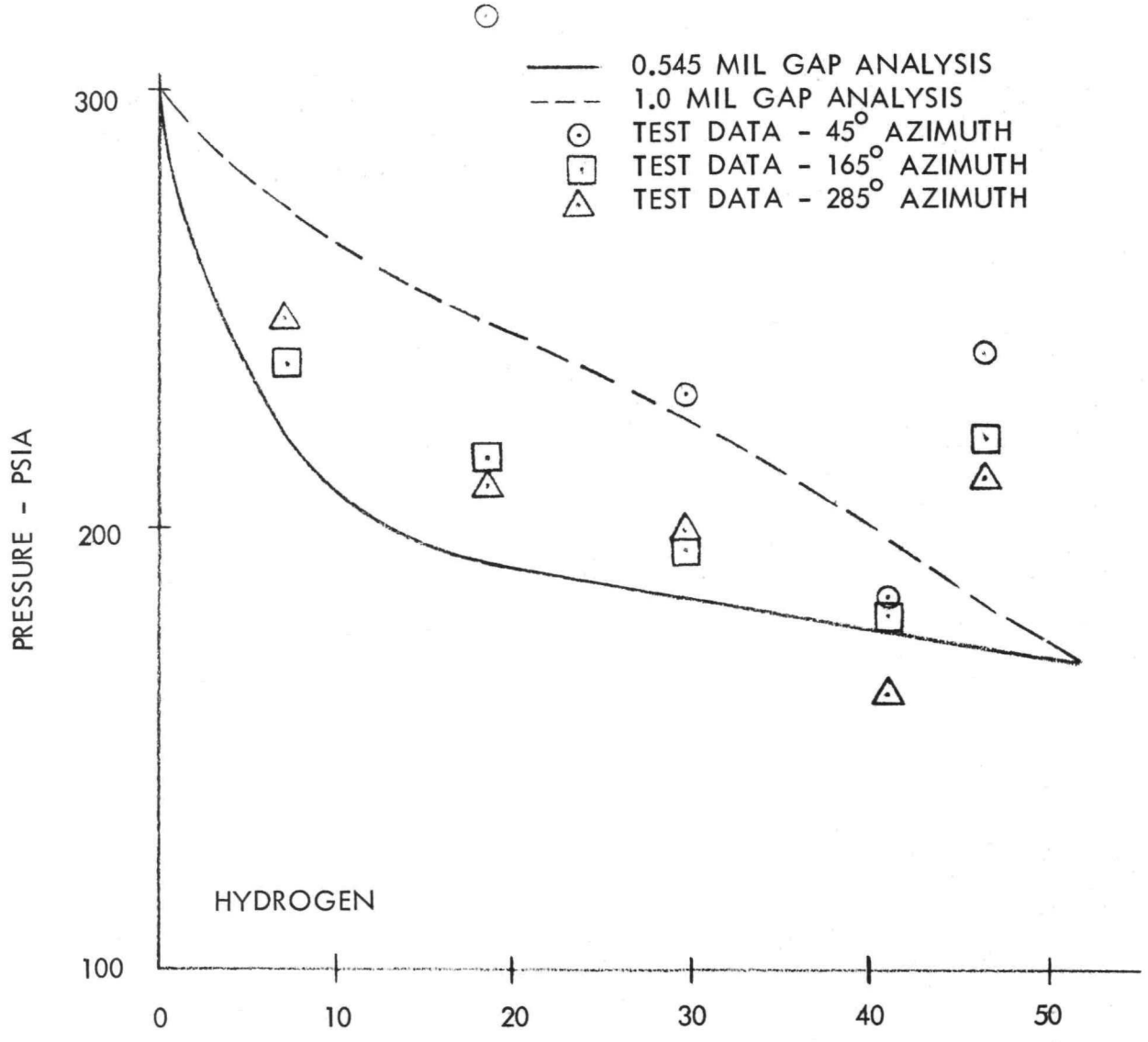
CORE EFFECTIVE GAP TEST COMPARISON OF TEST DATA AND ANALYSIS EFFECT OF ELEMENT PERMEABILITY



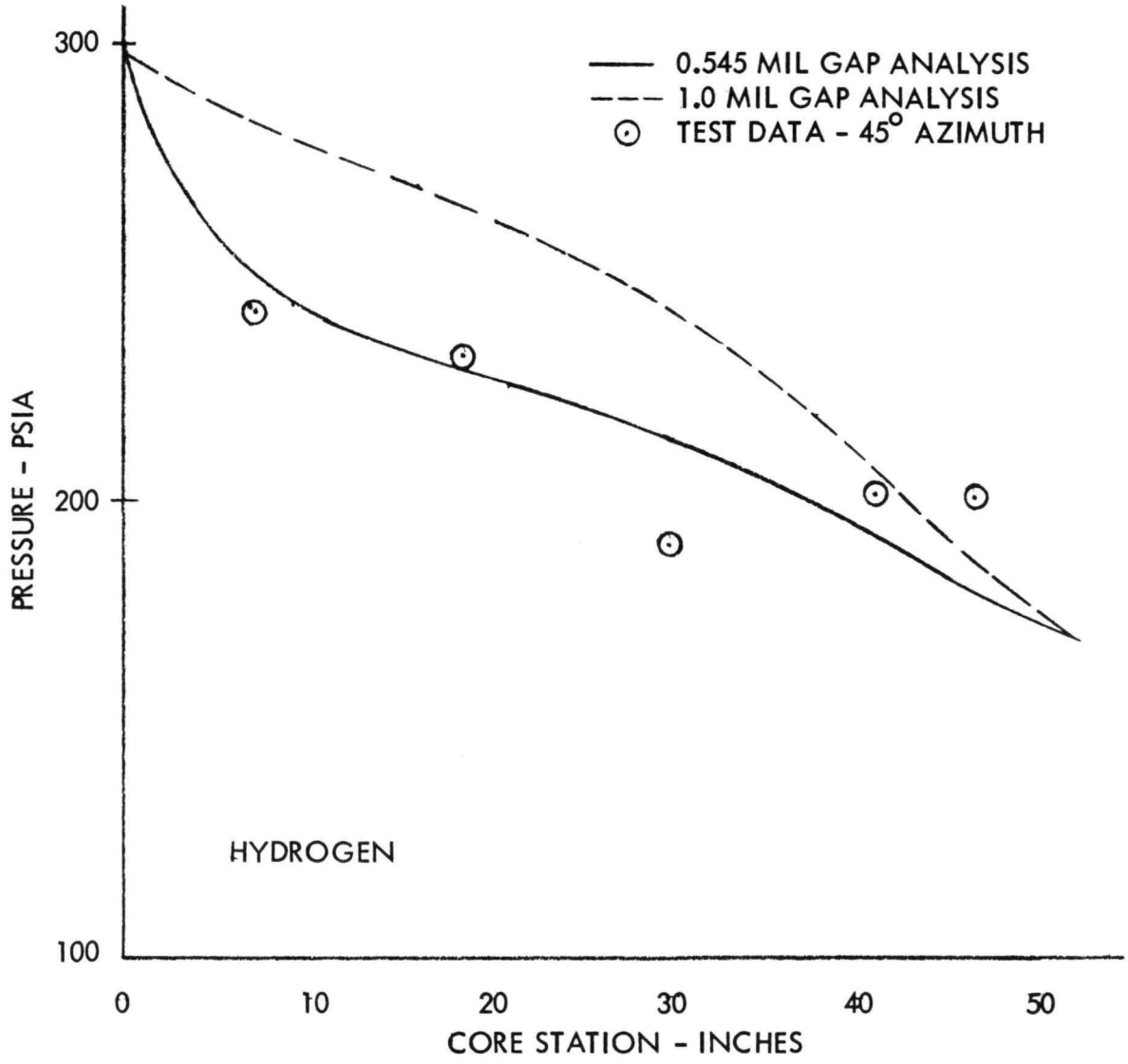
CORE EFFECTIVE GAP TEST
COMPARISON OF TEST DATA AND ANALYSIS



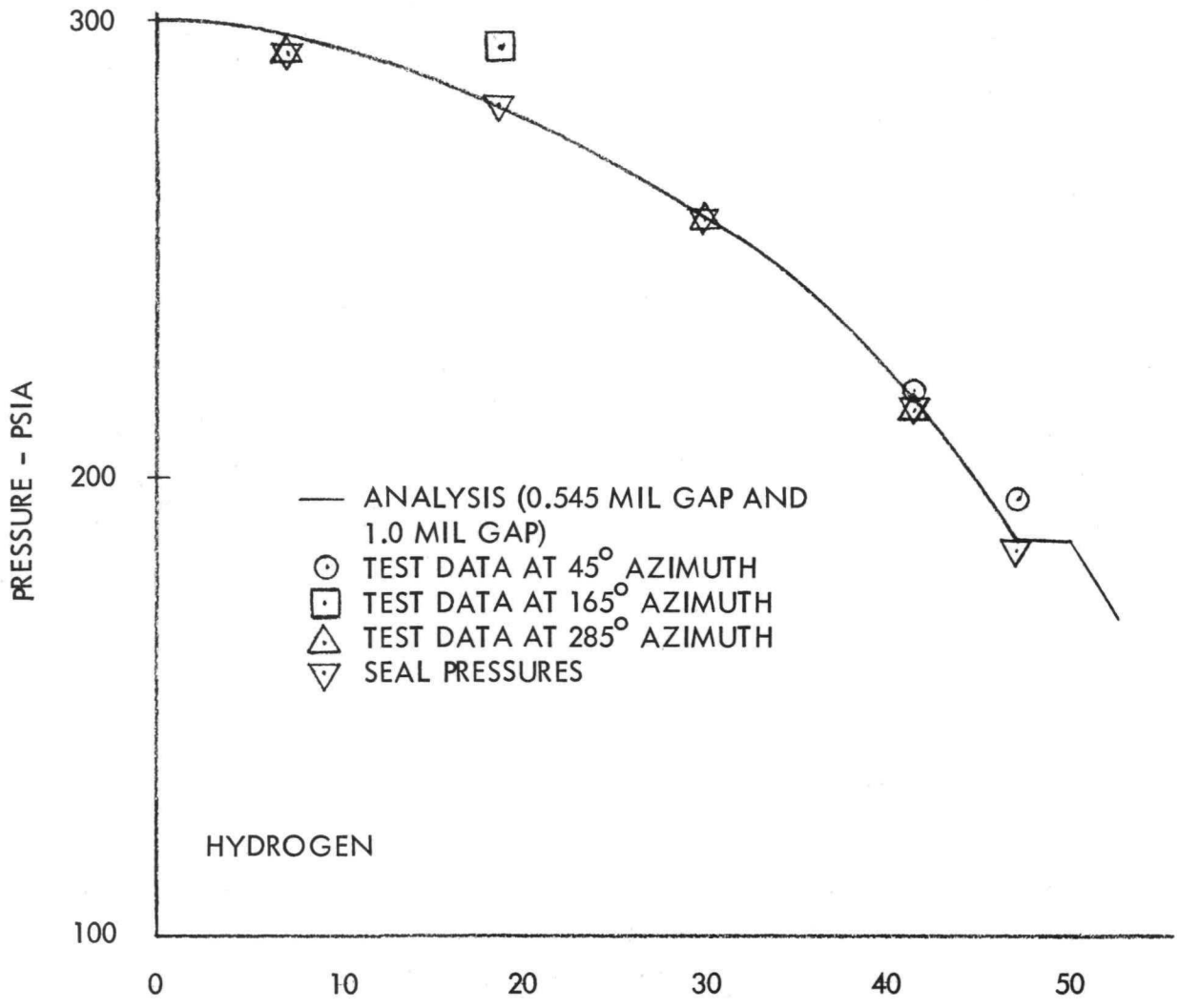
PLUGGED CORE TEST COMPARISON OF TEST DATA
AND ANALYSIS CENTERLINE PRESSURE DISTRIBUTION



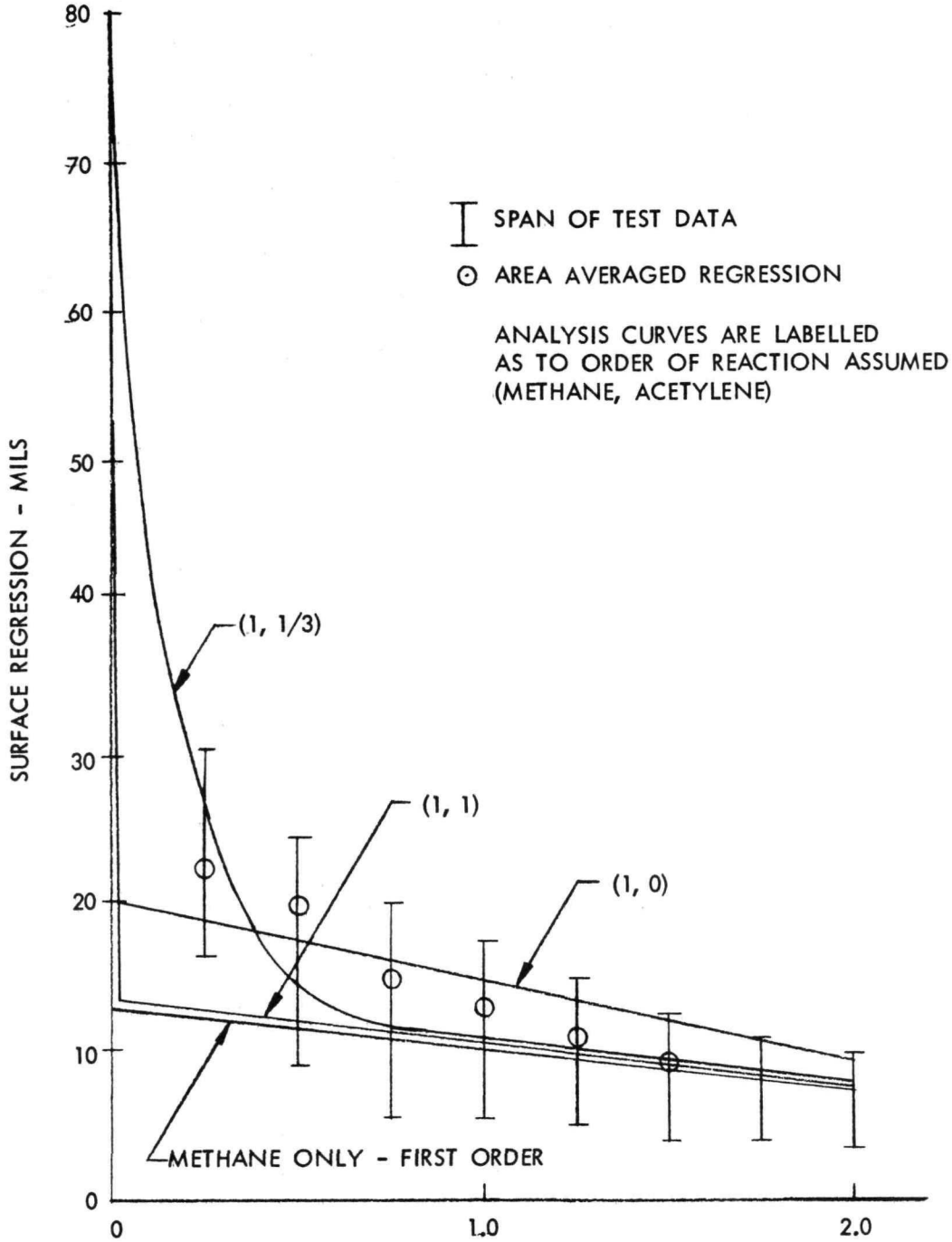
PLUGGED CORE TEST COMPARISON OF TEST DATA
AND ANALYSIS PRESSURE DISTRIBUTION AT 7.5 INCH RADIUS



PLUGGED CORE TEST COMPARISON OF TEST DATA
AND ANALYSIS PRESSURE DISTRIBUTION AT 13.5 INCH RADIUS

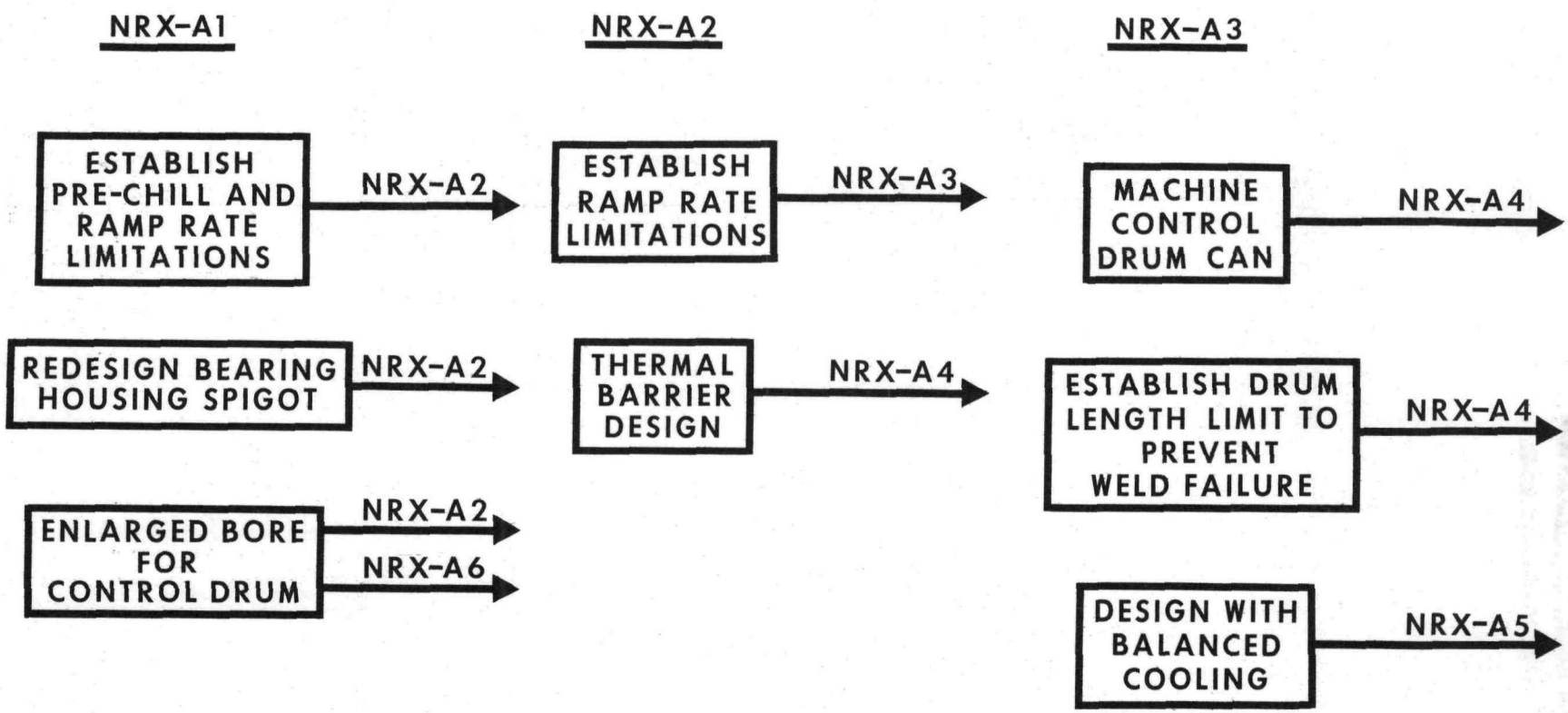


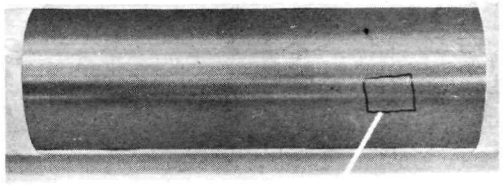
PLUGGED CORE TEST COMPARISON OF TEST DATA
AND ANALYSIS PRESSURE DISTRIBUTION AT 17.5 INCH RADIUS



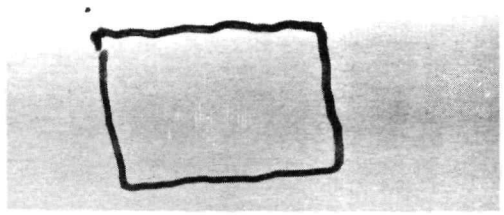
INTERSTITIAL CORROSION TEST
COMPARISON OF TEST DATA AND ANALYSIS

OUTER REFLECTOR TRANSIENT THERMAL GRADIENTS

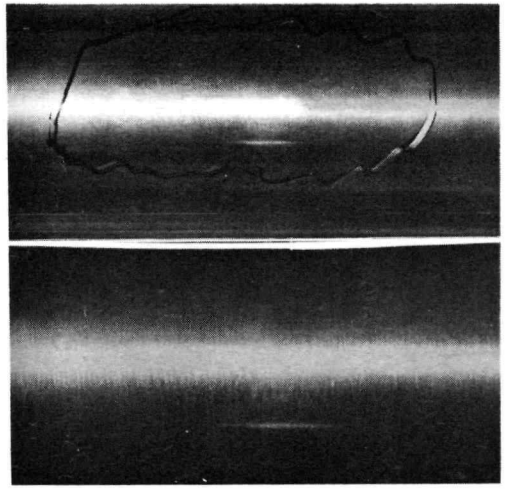




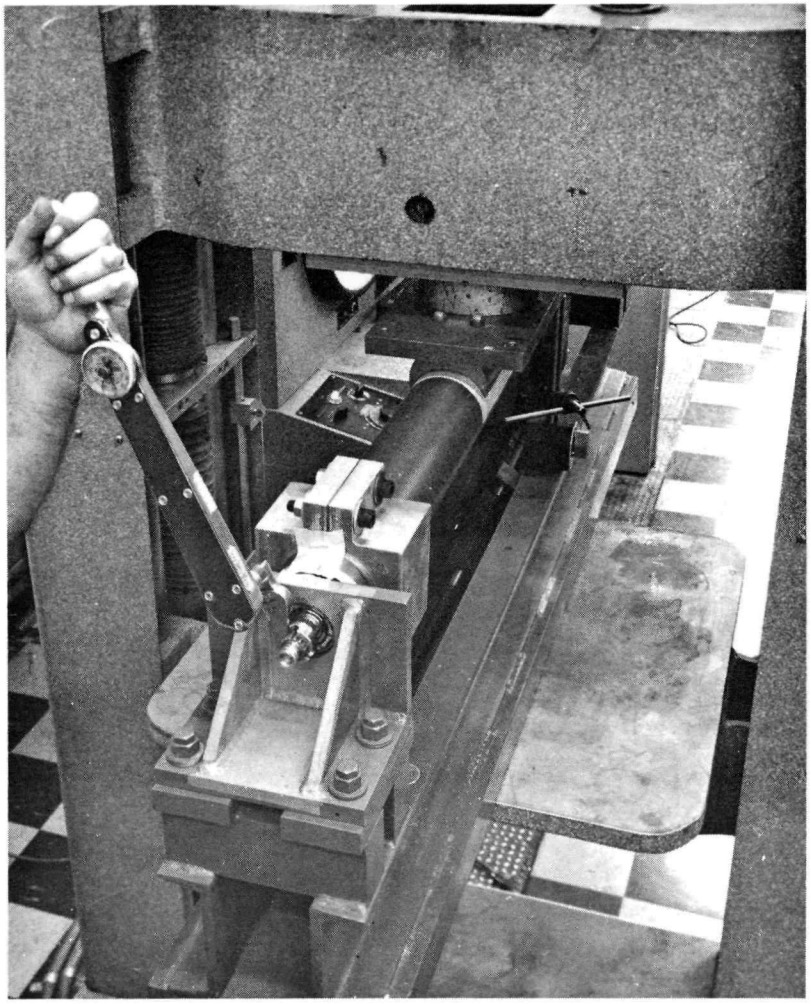
LABORATORY
TEST SETUP



DRUM SURFACE
AFTER
LABORATORY
TEST



DRUM SURFACE
AFTER A-3 TEST



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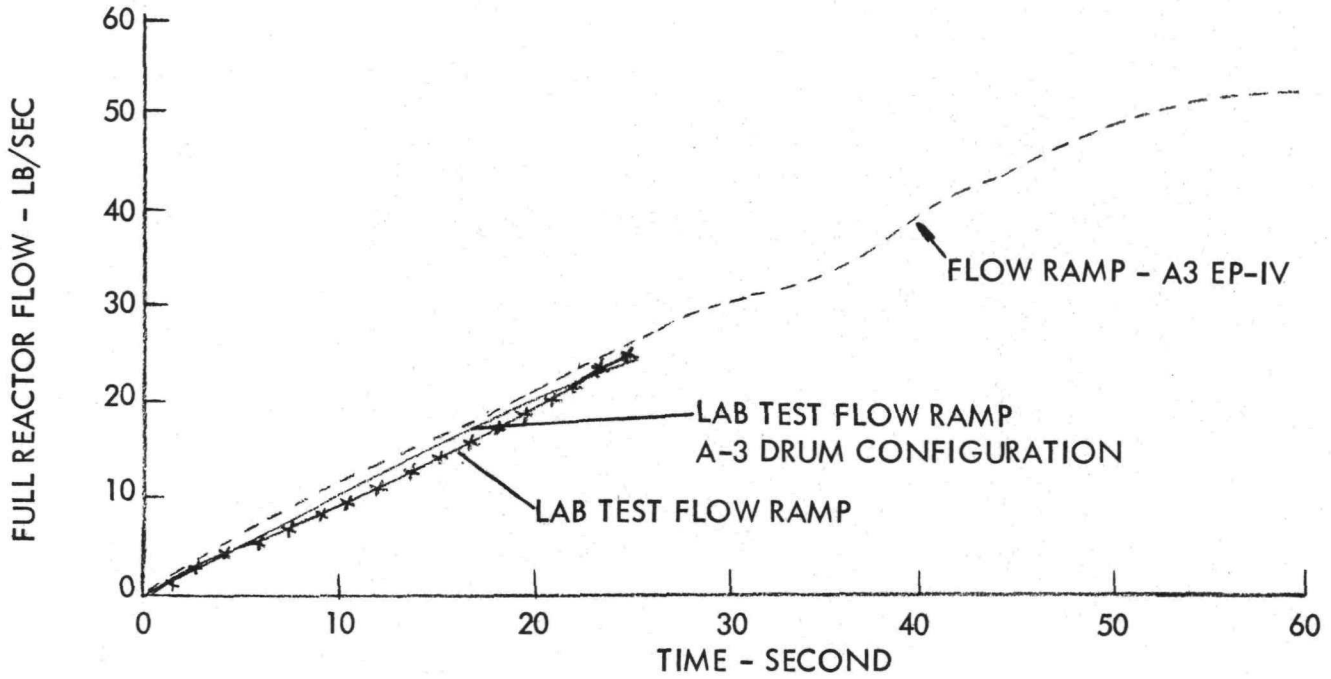
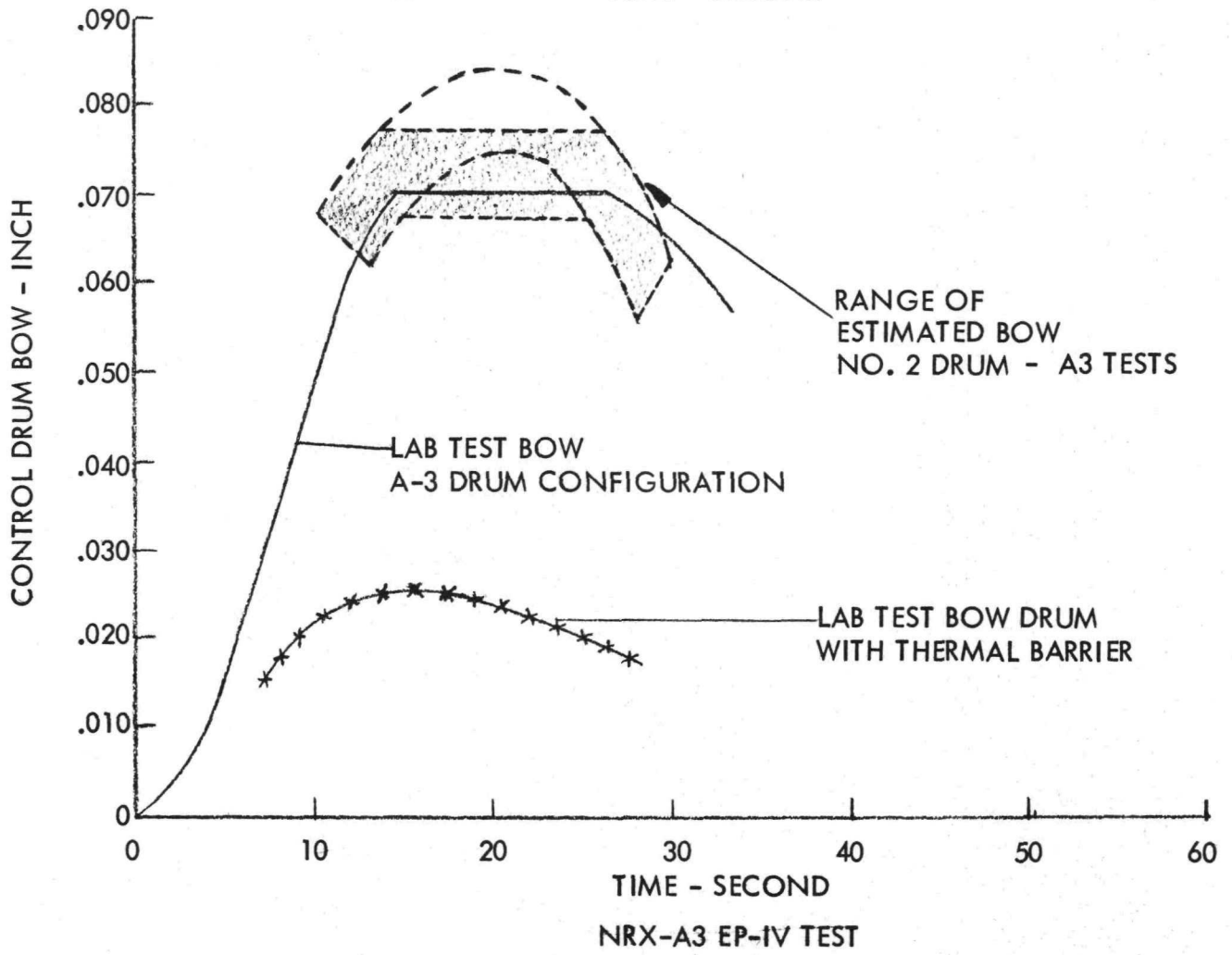
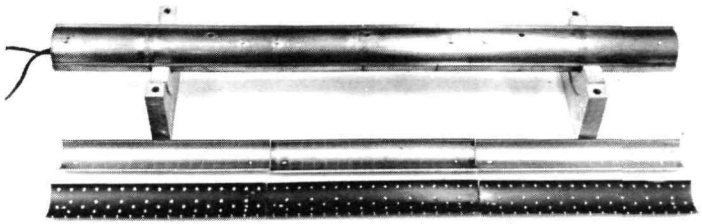
CONTROL DRUM REFLECTOR SECTOR RUB TEST

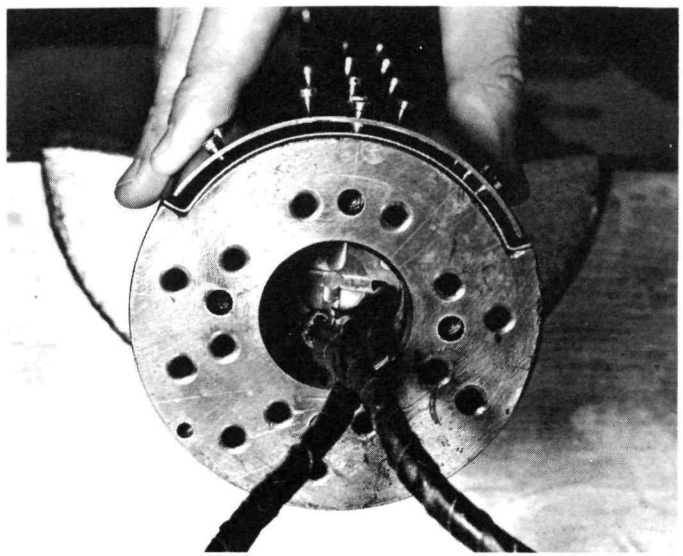




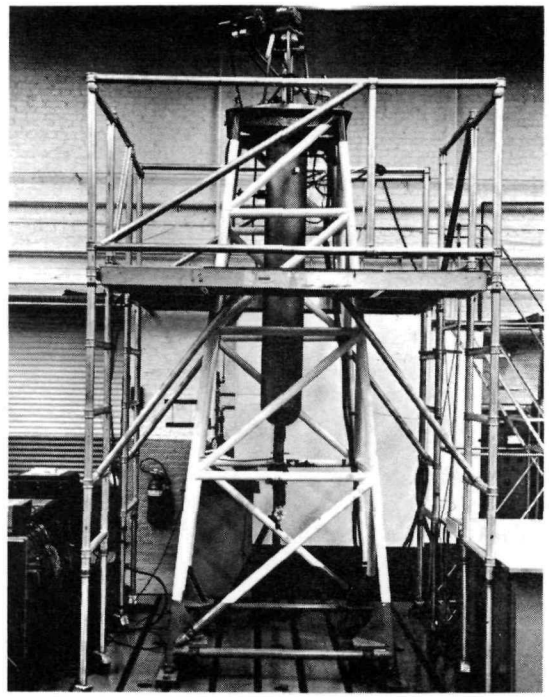
NRX-A3 EP-IV TEST



THERMAL BARRIER ELEMENTS



THERMAL BARRIER INSTALLED



TEST RIG

CONTROL DRUM BOW TESTS WITH THERMAL BARRIER

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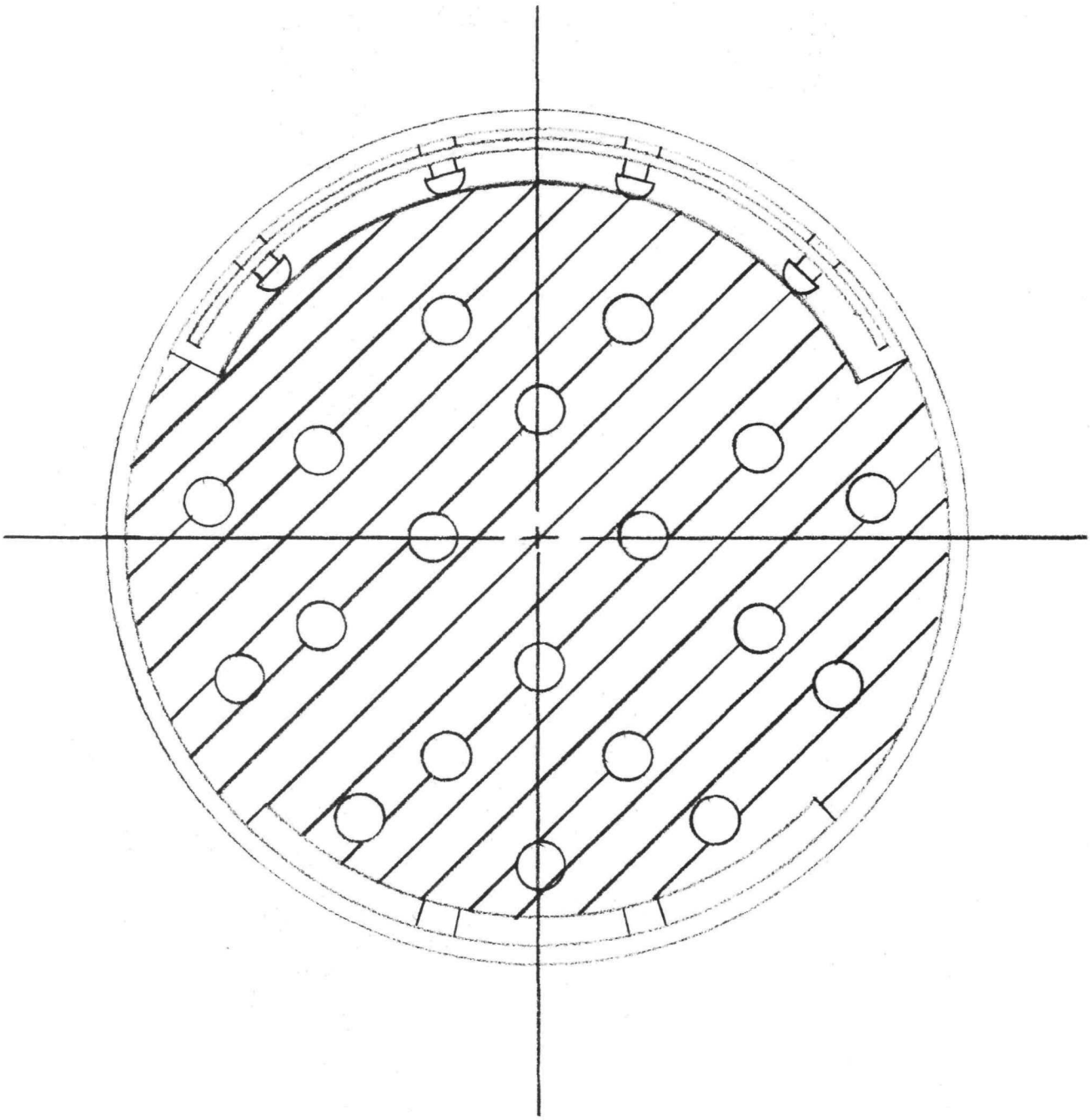
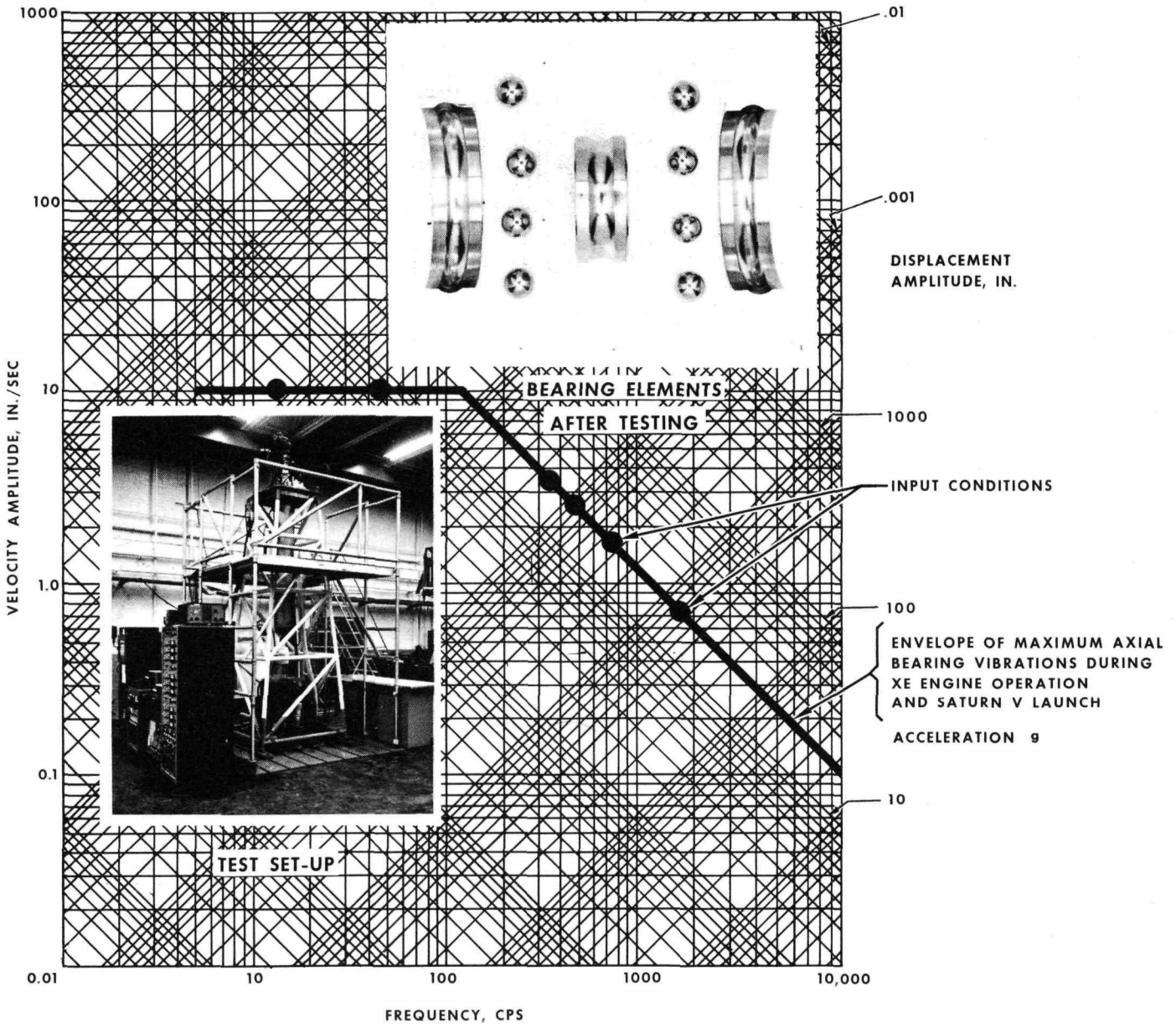


PROPOSED CONTROL DRUM MODIFICATION
TO REDUCE BOW

CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954



CONTROL DRUM BEARING AXIAL VIBRATION TESTS

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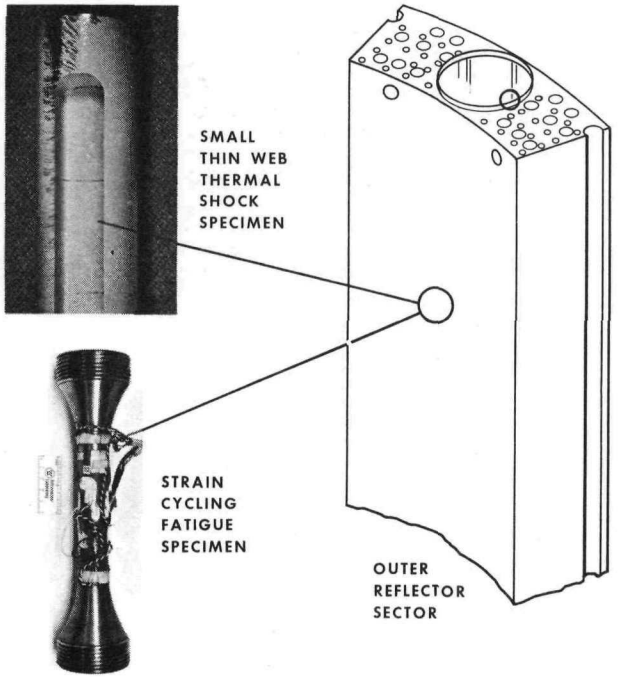

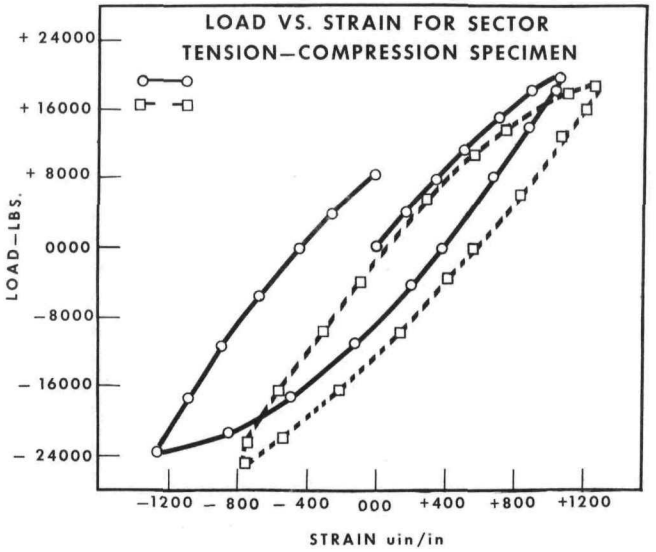

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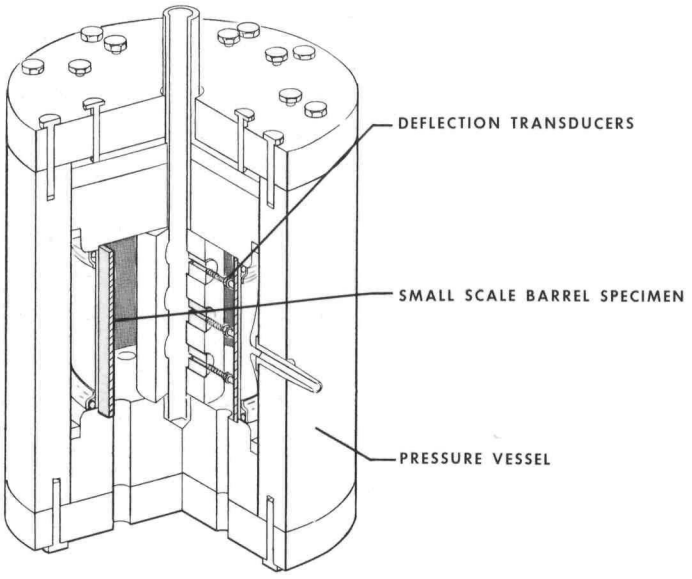
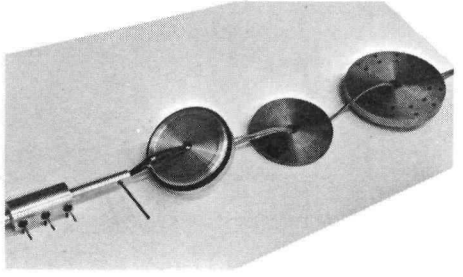
SECTOR THERMAL STRESS TESTS

DESIGN SUPPORT

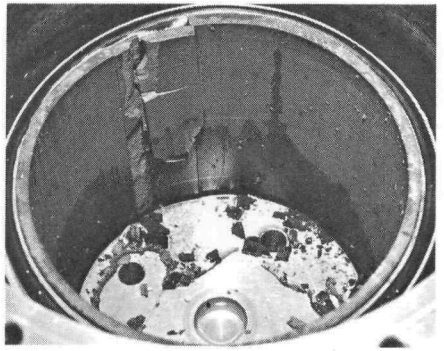
- FUEL ELEMENT YIELD
- MECHANICAL DESIGN PROPERTIES
- CONTROL DRUM BEARING LIFE
- INSTALLED INSTRUMENTATION CALIBRATION
- ORIFICE IMPEDENCE CHARACTERISTICS
- SMALL HARDWARE CHARACTERISTICS
- SEAL LEAKAGE TESTING
- VIBRATION TESTING



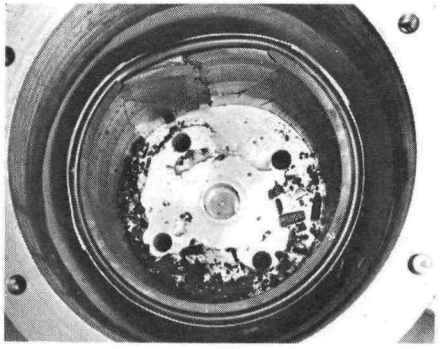
TEST FIXTURE



EXPLODED VIEW OF
DEFLECTION MEASURING SYSTEM



ONE PIECE BARREL
(.016 INCH EXTERNAL RESTRAINT)
FAILURE AT 575 PSI



BONDED STAVE BARREL
(.016 INCH EXTERNAL RESTRAINT)
FAILURE AT 525 PSI

SMALL SCALE BARREL TESTS

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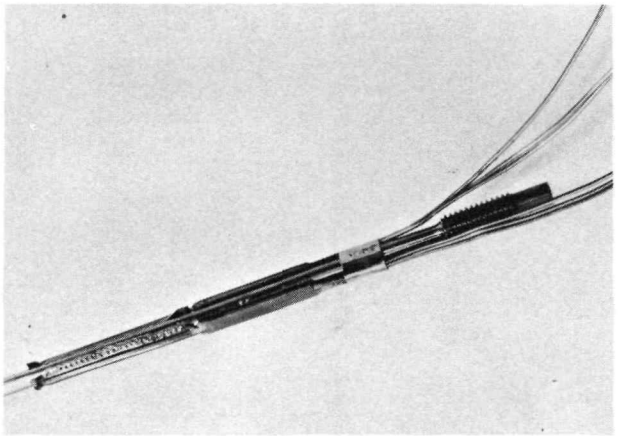
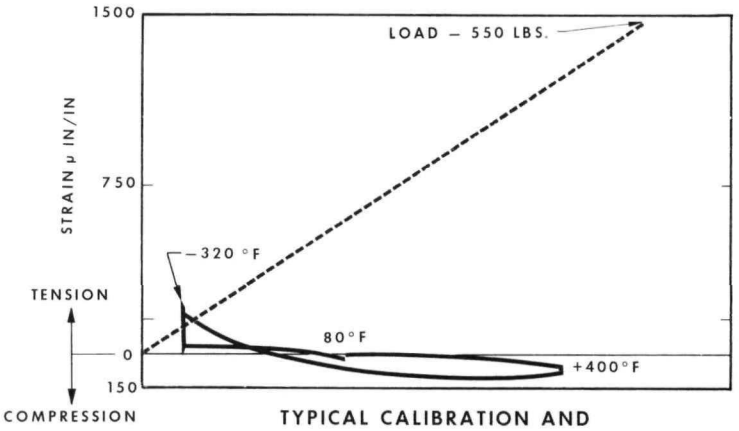
NRX-A3 AND NRX-A4 INSTRUMENTATION CALIBRATION AND PROOF TESTING

TIE RODS

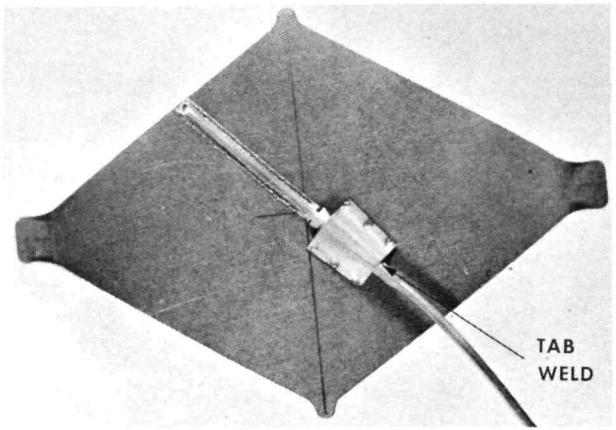


INSTRUMENTED TIE ROD



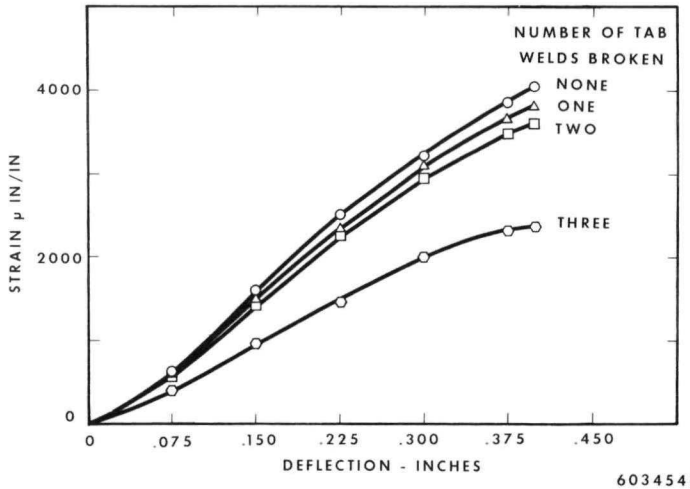
TYPICAL CALIBRATION AND APPARENT STRAIN CURVE

LATERAL SUPPORT SPRINGS



INSTRUMENTED LATERAL SUPPORT SPRING

EFFECT OF SUCCESSIVE REMOVAL OF TAB WELDS UPON CALIBRATION



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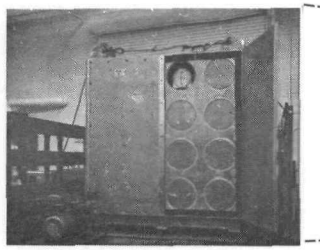
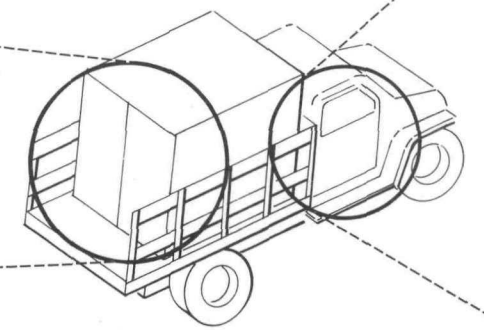
CONFIDENTIAL
RESTRICTED DATA
Atomic Energy Act - 1954

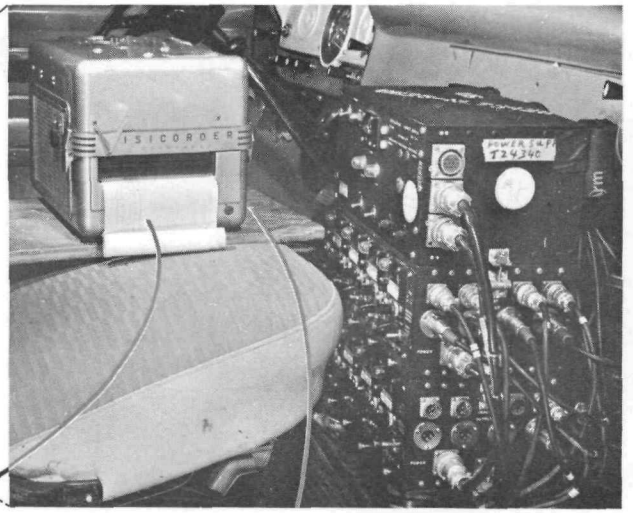
FUEL ELEMENT CONTAINER TRANSPORTATION TEST



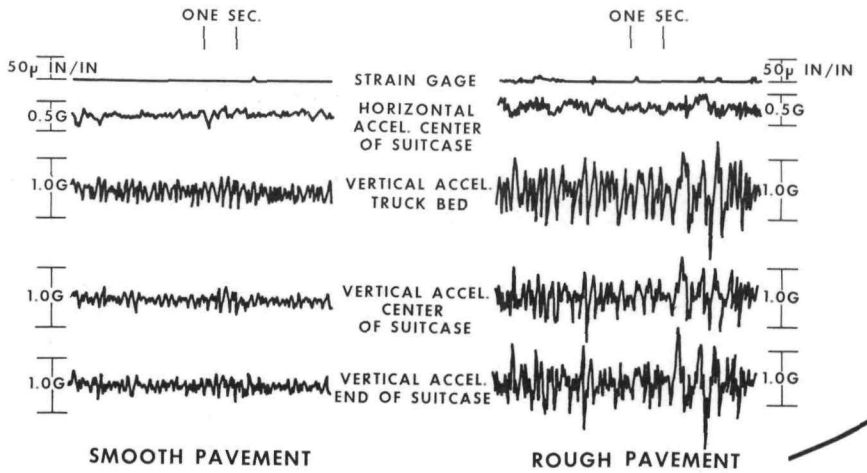
ELEMENT CONTAINER IN BIRDCAGE SHIPPING CONTAINER



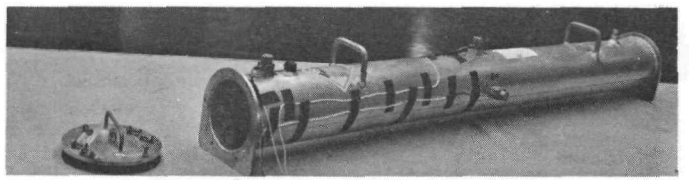
ROAD SHIPMENT FROM ASTRO FUEL LAB TO ASTRONUCLEAR LAB



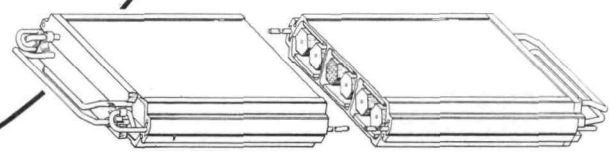
TRANSDUCER AMPLIFIER AND RECORDING SYSTEM



SAMPLE DATA RECORD



PRESENT ELEMENT CONTAINER ROAD TEST



NEW DESIGN ELEMENT CONTAINER ROAD TEST AND VIBRATION TEST

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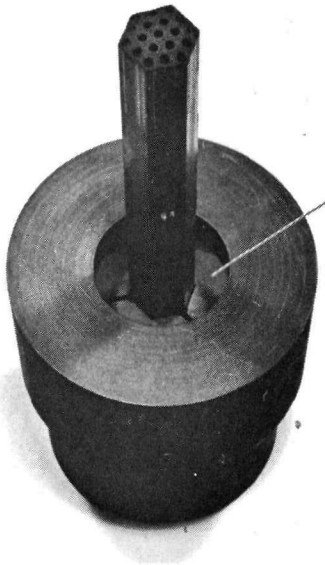
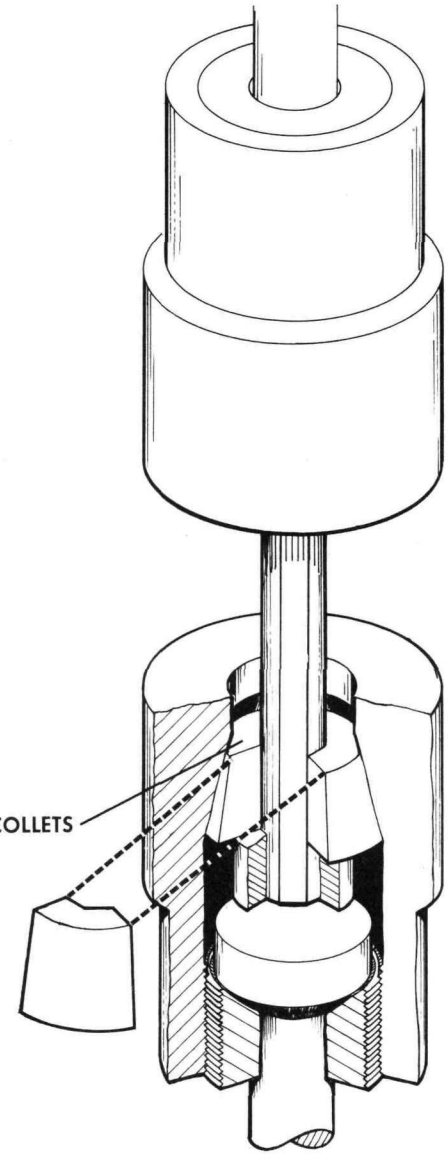
TENSION TEST FAILURE MODE





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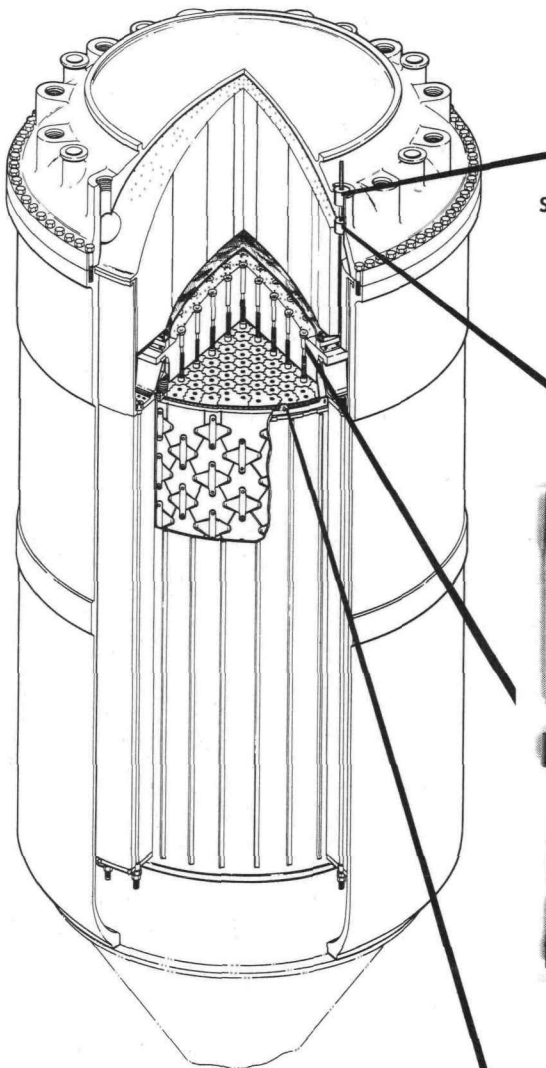
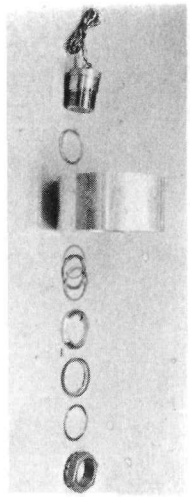
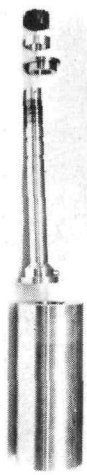
GRIPPING ARRANGEMENT AND FAILURE MODE
FOR FUEL ELEMENT TENSION TESTS



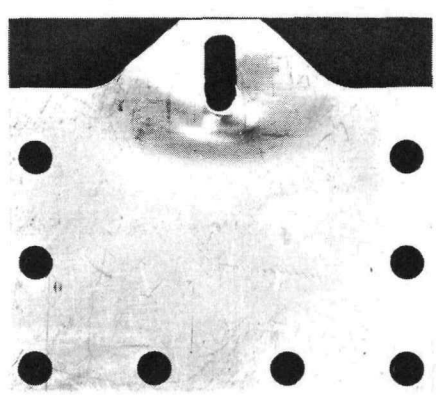


INSTRUMENTATION
SEAL BLOCK ASSEMBLY



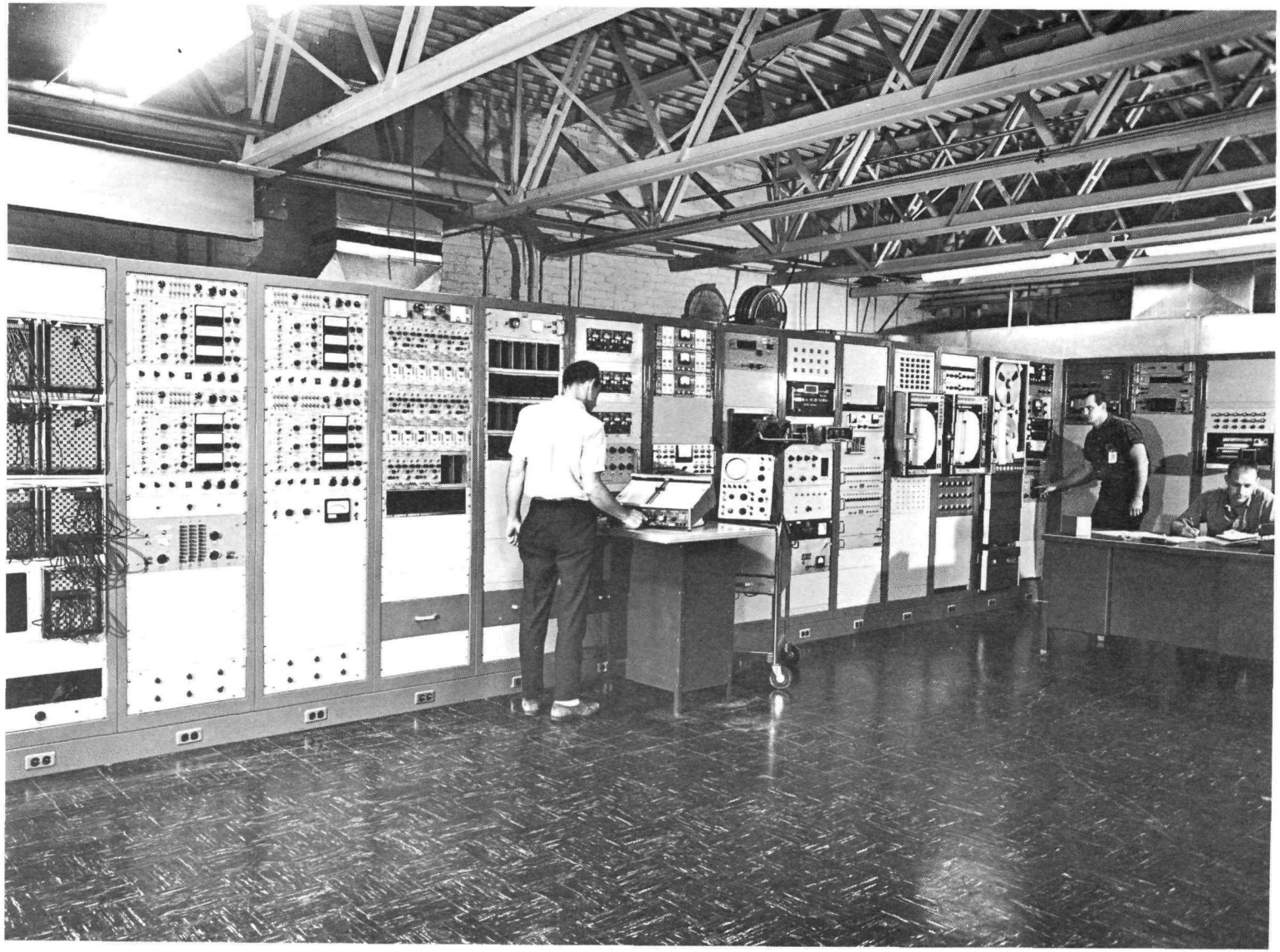
INSTRUMENTATION
SLEEVE ASSEMBLY

TIE ROD HOLDER-CLUSTER NUT
THREADED ASSEMBLY



CORE ASSEMBLY BARREL ATTACHMENT
TAB AFTER TESTING

REACTOR HARDWARE TESTS



FACILITIES IMPROVEMENT

FACILITY	PROGRAM PLANS	ADDITIONAL NEEDS
HIGH TEMPERATURE MECHANICAL LOAD	LOADING FURNACE WITH MORE VIEWPORTS AND IMPROVED LOADING CAPABILITY	LOADING FURNACE WITH HIGHER HYDROGEN CAPABILITY
FRICTION FURNACE	ADDITIONAL FACILITIES TO ACCOMMODATE LARGER SPECIMENS, PROVIDE BETTER MEASUREMENTS OF TEMPERATURE, NORMAL LOAD, FRICTION FORCE AND SPECIMEN MOTION	

FACILITIES IMPROVEMENT

FACILITY	PROGRAM PLANS	ADDITIONAL NEEDS
SINGLE ELEMENT CORROSION FURNACES	1. PARALLEL LOOPS FOR COOLANT AND ATMOSPHERE TO GIVE WIDE VARIATION IN FLOW AND GAS COMPOSITION. PARTS AVAILABLE — BUILD AND INSTALL WHEN MANPOWER IS AVAILABLE. 2. DEVELOPMENTAL FURNACE WITH MORE VIEWPORTS, SIMPLIFIED END CLOSURES AND TRANSITION AND BETTER ACCESSIBILITY. MEASURE TEMPERATURE AND MAKE VOLTAGE PROBE MEASUREMENTS AT 5 INCH INTERVALS. 3. WALTZ MILL VAPORIZER INSTALLED. OPERATIONAL IN OCTOBER. 4. SECOND FURNACE AND HEAT EXCHANGER IN PARALLEL.	CORROSION FACILITY WITH PREHEATER SECTION TO ELIMINATE ELECTRICAL INTERACTIONS CRYOGENIC HYDROGEN SUPPLY TO PROVIDE CORRECT TEMPERATURE DISTRIBUTION FOR CENTER HEX TESTS AND TIE TUBE TESTS

FACILITIES IMPROVEMENT

FACILITY	PROGRAM PLANS	ADDITIONAL NEEDS
CLUSTER CORROSION FURNACE	CLUSTER TESTING BUT WITH LIMITED LOADING CAPABILITY.	REDESIGN OF ENDS TO PROVIDE MORE LOADING FLEXIBILITY. NEED ADDITIONAL POWER TO OPERATE AT FULL POWER AND FULL FLOW. CAN RUN ONLY 80% FLOW AT FULL TEMPERATURE. MODIFY END CLOSURES TO PERMIT ADDITIONAL ROW OF ELEMENTS IN PERIPHERAL CORROSION RIG.
MULTIPLE CLUSTER FURNACE		NEED FACILITY TO EVALUATE PERIPHERAL DESIGN CANDIDATE AND MODIFICATIONS.

FACILITIES IMPROVEMENT

FACILITY	PROGRAM PLANS	ADDITIONAL NEEDS
HIGH TEMPERATURE MECHANICAL LOAD	ADDITIONAL LOADING FURNACE WITH MORE VIEWPORTS AND IMPROVED LOADING CAPABILITY	LOADING FURNACE WITH HIGHER HYDROGEN CAPABILITY
FRICTION FURNACE	ADDITIONAL FACILITIES TO ACCOMMODATE LARGER SPECIMENS, PROVIDE BETTER MEASUREMENTS OF TEMPERATURE, NORMAL LOAD, FRICTION FORCE AND SPECIMEN MOTION	

PERIPHERAL CORROSION

A. SINGLE CLUSTER PERIPHERAL CORROSION SIMULATION

   i. PYROSTRIP
   ii. HOT BUFFER
   iii. METHANE GENERATING PERIPHERY

B. ENCAPSULATED SPRING COOLING

C. HOT CAVITY MASS TRANSFER

D. HOT BUFFER LOCKUP EVALUATION

   i. THERMAL EXPANSION OF FILLER STRIPS
   ii. FRICTION BETWEEN PYROTILE AND COATED ELEMENTS

E. NRX-A6 SEAL SEGMENT FRICTION TESTS

F. NRX-A6 LATERAL SUPPORT SYSTEM STRUCTURE INTEGRITY

G. NRX-A6 LATERAL SUPPORT AND SEAL MODEL LEAKAGE TESTS

H. NRX-A6 REFLECTOR SEAL LEAKAGE

FUEL ELEMENT AND SUPPORT BLOCK CORROSION

A. SINGLE ELEMENT DEVELOPMENT CORROSION TESTS
   - i. BETTER REACTOR SIMULATION
   - ii. IMPROVED CHUCKS
   - iii. PINHOLE SIMULATION
   - iv. END AND UNDERCUT CORROSION EVALUATION

B. CLUSTER CORROSION TESTING

C. NON-SUPPORT BLOCK CLUSTER CORROSION TESTING AND MECHANICAL LOAD TESTING
   - i. EVALUATE CONCEPTS
   - ii. QUALIFICATION TESTING

D. SUPPORT BLOCK CORROSION TESTING

E. SUPPORT BLOCK MECHANICAL TESTING
   - i. TEMPERATURE AND LOAD
   - ii. BONDING AND FLAKING OF NbC INTERFACES

F. MECHANICAL PROPERTIES OF CORRODED ELEMENTS AND SUPPORT BLOCKS

G. ACOUSTICAL TESTS OF COATING INTEGRITY ON CORRODED AND UNCORRODED COMPONENTS

H. ORIFICE AND ORIFICE SEALANT TESTS

INTERSTITIAL CORROSION

A. CORROSION IN LONG NARROW GAPS WITH REACTOR TEMPERATURE DISTRIBUTION

B. CORROSION IN SHORT GAPS - ISOTHERMAL

C. SIMULATE WELDING OF ELEMENTS OBSERVED IN NRX-A3

D. CORE GAP AND PRESSURE DISTRIBUTION VS. BUNDLING. LOOK AT EFFECTS OF PINHOLING, LARGE GAPS, OVER-SIZE ELEMENTS AND RADIAL INFLOW

- - - - - -

CENTRAL ELEMENT AND TIE ROD INTEGRITY

A. CORROSION TEST OF NRX-A4 CONFIGURATION

B. CORROSION TEST WITH COUNTERFLOW TIE TUBE

- - - - - -

OUTER REFLECTOR TRANSIENT THERMAL GRADIENTS

A. CONTROL DRUM BOW TESTING - NRX-A5 AND NRX-A6

B. NRX-A6 OUTER REFLECTOR MODEL TESTS
THERMAL SHOCK AND THERMAL GRADIENT

DESIGN SUPPORT

A. MECHANICAL TESTS TO EVALUATE COMPONENTS SUCH AS CLUSTER NUTS, TIE RODS, INSTRUMENTATION SEAL BLOCKS, ETC.

B. RESONANCE OF REACTOR ON ETS ASSEMBLY

C. MINOR SEAL TESTING

- - - - - -

PROBLEMS ARISING FROM REACTOR TEST RESULTS

A. MUST HAVE FACILITIES AND CAPABILITY TO RESPOND RAPIDLY TO MAJOR PROBLEMS

   i. NRX-A3 FLOW SCRAM
   ii. SUPPORT BLOCKS

B. NEED MARGIN TO EVALUATE DESIGN CHANGES

C. DAY-TO-DAY PROBLEMS NEEDING TEST RESULTS